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The Iron Age

MAY 23, 1940

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Better Service . . .

THERE are two schools of publishing. One, and it is the minority school, believes that the editorial contents and format should be primarily designed to impress the buyer of advertising. The other and more conservative school of publishing believes that the chief asset that an advertiser has in any industrial paper that he uses is its ability to render service to its readers.

We admit belonging to the latter school. We believe that in the case of any publication, its readers are automatically attracted by the kind and quality of editorial contents that it contains, its acceptance by these readers is measured by the service that it renders and that its value to an advertiser depends entirely upon these factors.

It is upon this firm belief that The Iron Age has always been edited and published. And always will be as long as its present management and that of its parent company, the Chilton Co., are directing its affairs.

Any changes, therefore, that are made in the format of The Iron Age, are designed, first and foremost, to render a better service to its readers.

This issue marks such a change.

You will note some of them as you turn over the pages of this number.

First, although not foremost, you will note that there is a larger trimmed size to the paper. This is a contribution toward the standardization movement, which when fully followed by other publications, will make it easier to file past issues as well as render the page appearance more inviting because of larger margins.

Next, you will probably note a change in typography designed to make an easier reading page as well as a more attractive one. In this connection, we have taken advantage of the advice of an outstanding authority, Heyworth Campbell, as well as of the combined experience of our own staff experts. These changes are designed to save approximately 15 per cent of the reader's time in his coverage of a given amount of material.

Finally, there has been a change in make-up or continuity. In a "last minute" industrial newspaper such as The Iron Age, which is put to press only 12 hours before mailing, there has, in the past, been a certain scattering of last minute news items. With our new make-up, this has been eliminated. Hereafter, for example, you will find all news in the news section. And you will find this section, as all others, always in the same relative position in the book.

Another innovation is the insertion of a separation between the technical and commercial sections of The Iron Age, in the form of a stiff insert. This will be particularly useful to the many readers who have occasion to refer to back copies for statistical information or production and technical articles.

We hope that you will like The Iron Age in its new suit of clothes. They are designed for wearing quality and for reader service.

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STAINLESS STEEL 1939

Not producers, but consumers - 2956 of them - report on consumption and distribution, and contribute a number of worthwhile suggestions. It was very much a record year for production, with much new capacity built and a building. And as for technical advances, there was a goodly amount of pulling and hauling, some startling publicity campaigns, and a few hesitant steps along unconventional metallurgical paths.

By T. W. LIPPERT
Metallurgical Editor, The Iron Age

° ° °

MOGILEVSKY, once a prominent member of the Cheka in the U.S.S.R., has been quoted as saying: "After we work over a man for a while, he will agree to anything in exchange for the greatest boon he can think of, the privilege of being shot."

The efficient Mogilevsky, of course, was experienced only with ordinary men, and likely had no opportunity to practice his refined art on a maker of alloy steels. There is more than a little doubt that even Mogilevsky at his best could wring from all American producers of alloy steels, including stainless steels, accurate yearly production figures broken down as to analyses and grades and distributed as to consuming industries. And, of course, just as a conjecture, perhaps if Mogy had tackled such a problem it might have ended with his pleading for the boon of a firing squad.

Producers of alloy steels are by inclination and frequently by necessity secretive. For nine years (1929-1937) THE IRON AGE went to producers of stainless steel for yearly output data. Success was in varying degree. Some years all but several producers would cooperate, other years one or two rather important ones would take a walk. And every year it was necessary to revamp some figures as dictated by personal investigation. What with these sources of errors in some directions and also returns with incomplete breakdowns in other directions, the survey was so enervated as to warrant abandonment in 1938.

For 1939 this important problem was addressed in a completely different manner—which though of considerable complexity and of large comparative expense, promised to yield valuable and extremely interesting data.

The plan was to go to all known United States consumers of stainless alloys, asking each for his 1939 consumption as to product and analysis. Accurate mailing lists were necessary, and after some hesitancy two stainless producers offered their roster of customers as well as all known prospects. The lists were matched against each other and a few names appeared on each that the other did not have. The final work list was made up of 3582 individual concerns.

The returns pouring back from the consumers were startling in both number and accuracy. In all, 2956 positive returns were made; 161 of the companies contacted had either gone out of business or used no stainless during the year. The 465 hold-outs after a follow-up letter included eight moderately large consumers and the remainder were known to be typically small consumers. Fairly accurate breakdowns were secured for the eight companies by personal investigation and the 457 remaining companies were dis-

tributed proportionally in the survey to adjust the tonnages to 100 per cent consumption.

A collocation of the figures—which ranged individually from a few pounds to many hundreds of tons—disclosed some interesting results. Quite obviously sheets have suffered considerable retrogression vis-á-vis strip, and bars and rods occupy a far more prominent position than had been anticipated. The 18-8 analysis is first as regards popularity, accounting for almost 50 per cent of the 1939 consumption, with 16-18 straight-chromium placing and 12-14 straight-chromium showing.

A complete breakdown of the 1939 consumption survey is shown in Tables I, II and III on this and the opposite page. The graph opposite serves to give a quick summary of the 1939 figures, and visually emphasizes the sharp recovery from the 1938 recession and the over-all upward march of stainless consumption since the 1932 nadir. Table IV breaks down the 1939 figures both as to product and analyses. Note that comparative figures from producer surveys of previous years are given in these tables, although certain sections of those previous surveys are now considered of questionable accuracy.

The consumption data submitted by consumers is in the form of *finished steel*. And, therefore, some scheme of reversed conversion had to be devised to show these figures in the form of ingots, so that the year's performance can be compared with past years in Table III. To do this requires a kind of by-guess-and-by-God technique flavored with the results of some personal investigation. Some of the figures collected by the American Iron and Steel Institute have shown in recent years an average conversion from ingot to finished steel of about 59 per cent, which of course takes care of hot-top crop, grinding losses, cut back during hot rolling, etc. The writer is of the opinion this average is a little too low.

The highest conversion is for bar, heavy rods, wire and wire rods, for which a pretty conservative estimate of major plant practice would indicate a figure of 68 per cent. For strip the conversion would be close to 60 per cent; and for sheets, plates and shapes the conversion should run on the average near 57 per cent. For tubular goods and forgings a guess would be, say, 60 per cent.

So, if each of these conversions is applied (in reverse) to the proper total finished steel figure shown in Table I, the ingot output for the year can be obtained. And, this ingot output compared with the finished steel total indicates an average over-all conversion of about 62 per cent. Using this 62 per cent conversion (again in reverse) on the totals by analysis shown in Table I permits the obtaining of calculated total ingots by analysis for inclusion in Table III. It all may appear a little complicated, but it is a method of weighting the various components to arrive at what is believed to be the most sensible calculated ingot tonnages.

Table III therefore indicates a calculated 1939 ingot output of all analyses of 168,644 net tons, which is a good 4 per cent above the 1938 total and about 24 per cent above the previous record year of 1937. Indeed, it is a most encouraging snap-back for the stainless steel industry and augurs well for the future.

In sending out the report blanks to the consumers, the thought was in mind that perhaps space could be made available for them to register kicks or make suggestions to the producers. And how they loved it! A compilation of these suggestions is shown on page 39 herein. As would be expected, the bulk of the suggestions were duplications. The consumers think stainless steel prices are unnecessarily high, that mill stocks are too low and delivery service is haphazard, that there is far too much confusion in trade names, etc., etc., as set forth specifically herein.

TABLE I

Consumption* of Finished Stainless and Heat-Resisting Steels—1939

(In Net Tons)

Product	Analysis Groups, Per Cent Composition					All Others	Total Consumption, All Analyses
	18% Cr & 8% Ni	25% Cr & 12% Ni	12% to 14% Cr	16% to 18% Cr	18% to 30% Cr	(Cr and Cr+Ni)†	
Sheets	13,162	105	622	1,705	22	5,891	21,507
Bars and heavy rods	3,735	952	4,505	3,421	66	12,103	24,782
Strip (hot & cold rolled)	25,769	1,381	479	11,761	17	930	40,337
Tubular goods	1,282	34	22	102	363	842	2,645
Plates and shapes	924	94	88	165	22	605	1,898
Wire and wire rods	2,157	55	1,429	4,827	50	231	8,749
Forgings	297	1,931	2,239	33	41	101	4,642
TOTAL	47,326	4,552	9,384	22,014	581	20,703	104,560

*These figures based on returns from an estimated 86.4 per cent of all known consumers of these types of alloys—figures shown are adjusted to 100 per cent consumption.

†These figures include undistributed tonnages in the analyses groups at the left as well as special analyses not warranting individual listing.

TABLE II

Consumption* of Stainless and Heat-Resisting Castings—1939

(In Net Tons)

18% Cr & 8% Ni	25% Cr & 12% Ni	12% to 14% Cr	16% to 18% Cr	18% to 30% Cr	All Others (Cr & Cr+Ni)	Total Consumption, All Analyses
1,204	1,293	551	375	298	5,925	9,646

*These figures based on returns from an estimated 94 per cent of all known consumers of these types of alloy castings—figures shown are adjusted to 100 per cent consumption.

Details on 1939 Survey

It is apparent from Table I that stainless in strip form occupies the dominant position, accounting for 38 per cent of total consumption. It is, of course, the automobile and streamline railroad train demands that have pushed this strip output far above sheet tonnage. In strip, note that the 18-8 and the 16-18 per cent straight-chromium analyses are by far most popular. Both these groups are very corrosion resistant and can be deep drawn and formed with almost the ease of soft cold rolled steel. The 18-8 grade of strip contains a number of modifications as, for instance, 18-8 columbium and 18-8 titanium, for use in numerous applications where welding operations are involved, and an 18-8 molybdenum type is growing more popular for special applications involving resistance to particular types of acids.

The 25-12 Cr-Ni analysis of strip showed considerable popularity, with a consumption of 1381 tons. This steel being non-magnetic is used in certain sections of airplanes, and because of resistance to high temperature oxidation it finds extensive application in industrial furnaces, and is employed to great extent in pulp and paper equipment. The 12 to 14 per cent straight-chromium strip is also fairly impor-

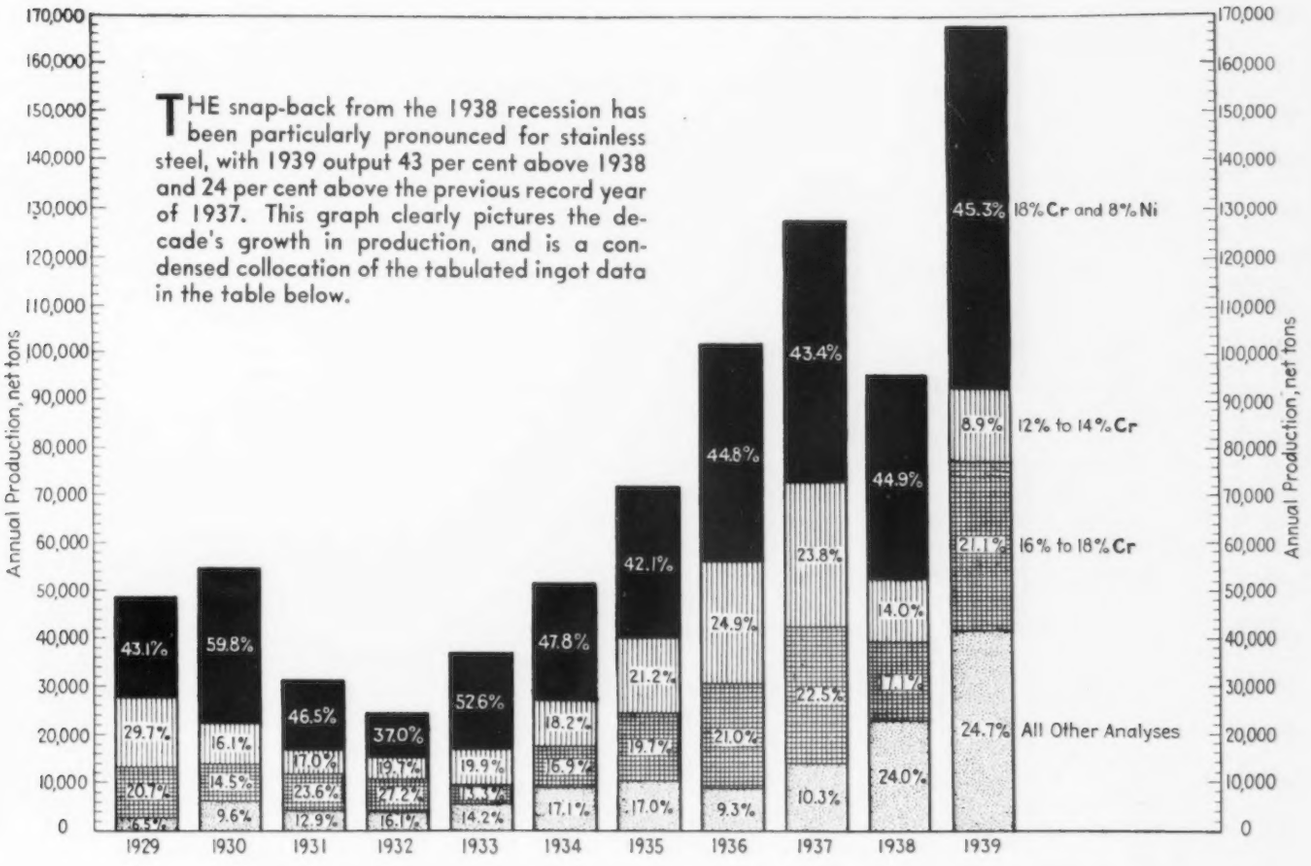

TABLE III

Production of Stainless and Heat-Resisting Ingots and Castings in the United States (1929-1939). By Analysis Groups.*

Ingots:	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939‡
18 Cr and 8 per cent Ni	21,074	32,867	14,740	9,209	19,620	24,818	30,114	45,800	55,011	43,129	76,332
25 Cr and 12 per cent Ni	....	....	....	....	....	....	3,827	5,530	6,423	(?)	7,342
12 to 14 per cent Cr	14,552	8,821	5,397	4,900	7,401	9,470	15,220	25,430	30,186	13,429	15,135
16 to 18 per cent Cr	10,127	7,995	7,483	6,751	4,969	8,787	14,101	21,478	28,500	16,454	35,506
18 to 30 per cent Cr	....	....	....	....	....	....	1,606	1,022	1,615	(?)	937
All others (Cr and Cr-Ni)**	2,950	4,792	3,438	3,312	5,262	8,832	6,713	2,900	5,107	22,942	33,392
Not allocated	187	474	622	660	....	....	....	....	....	....	....
Total	48,890	54,949	31,680	24,832	37,252	51,907	71,581	102,160	126,842	95,954†	168,644
Castings:											
18 Cr and 8 per cent Ni	310	271	225	384	352	387	446	874	1,165	578	1,204
25 Cr and 12 per cent Ni	....	....	....	....	....	....	760	1,280	1,430	612	1,293
12 to 14 per cent Cr	18	15	29	23	36	86	113	96	108	276	551
16 to 18 per cent Cr	156	96	192	237	225	164	288	295	332	261	375
18 to 30 per cent Cr	....	....	....	....	....	....	208	186	262	123	298
All others (Cr and Cr-Ni)**	3,326	2,930	2,264	1,257	2,126	3,036	2,173	3,170	4,702	2,180	5,925
Not allocated	1,392	1,009	511	285	54	201	83	....	....	....	....
Total	5,202	4,321	3,221	2,186	2,793	3,874	4,071	5,901	7,999	4,030	9,646
GRAND TOTAL (ingots and castings)	54,092	59,270	34,901	27,018	40,045	55,781	75,652	108,061	134,841	99,984	178,290

†American Iron and Steel Institute figures. Does not include low-alloy valve steels covered in various IRON AGE surveys.

‡Converted from consumption survey, as explained in text.

*Analyses groups are approximate; in several classifications each element may vary as much as ±2 per cent from the range shown, or may contain other elements such as molybdenum. In the case of *castings* a sizable percentage of the tonnage in any of the straight-chromium classifications may contain from 0 to several per cent nickel.

**This "catch-all" contains many analyses groups: In *finished steel* there are included such analyses as 4 to 6% Cr, 25 Cr-20 Ni, 5 to 8% Cr, 15 Cr-35 Ni, etc.: For *castings*, by far the three most prominent are the important heat-resisting analysis 33-36 Ni and 15-17 Cr; the popular analyses in the range 60+ Ni and 10-17 Cr; and the slightly less important analysis group 36-40 Ni and 18-20 Cr. In 1937 these three groups accounted for approximately 950, 500 and 230 tons respectively.

tant. This classification includes the 0.10 C, 12-14 Cr (410) classification; the 0.10 C, 12-14 Cr, 2 Ni (414); the 0.30 C, 12-14 Cr (420) classification; and other less popular variations. These steels are used for cutlery, springs, steel tapes, etc.

The second major outlet of stainless is in bar and heavy rods. Here again each major classification shown includes quite a number of variations and modifications, with some incidental titivation for merchandising purposes. Bars and rods of the 18-8 analysis are apparently most in demand, with 1939 consumption at 3735 tons. This analysis group covers a number of variations including free-machining modifications. These alloys work harden rapidly, are very tough and possess excellent corrosion resistance. The second most popular grade of stainless in bar form is 12-14 per cent straight-chromium, with 1939 consumption indicated as 4505 tons. The bulk of this group is probably the 0.10 C, 13 Cr grade, which is made mostly of valve and turbine types, although some has sulphur or selenium (416) added to give free machinability. This steel does not need heat treatment to impart quite satisfactory corrosion resistance, and has excellent hardness and is tough withal.

It is the addition of free machining elements to stainless bar stock (and wire) that over the past few years has overcome consumer resistance and greatly expanded sales, and sales of this free-machining steel now runs alone to a probable 5500 tons yearly. Considerable work has been done in the past year to determine whether sulphur or selenium is the better additive element for free machining, but the results have been rather inconclusive. In private correspondence, one producer states that there is no difference between the two in quality of surface after threading, but seemed to think that selenium gave a superior finish during reaming. For other machining operations, it appeared that sulphur in 18-8 alloys increases tool life in turning and drilling to a greater extent than selenium. However, these tests are far from complete and are being continued to determine exactly what are the attributes of each.

The large tonnage of bars shown in the "all other" classification is made up in great part by valve steels and special analyses for chemical work. In connection with aircraft engines, one popular valve steel is 13-15 Cr, 13-15 Ni, 1.75 to 3.0 W, 0.50 Mo, 0.40 to 0.50 C and 0.30 to 0.80 Si. And, of course, there is included large tonnages of the popular chromium-silicon valve steels of the 8/3 type, and modifications thereof. Also included is the increasingly popular 16-2 Cr-Ni combination.

Sheets constitute the third largest outlet, with 1939 consumption indicated in Table I as 21,507 tons. In sheets the 18-8 classification is by far the largest, which includes the ordinary 18-8 (304) and many different variations and modifications. These sheets are used to a large extent by food handling equipment makers, in architectural work, in the milk industry, etc. The 16-18 per cent chromium grade is next in popularity, with 1939 consumption indicated as 1705 tons. This grade, and certain modifications are used where not as great corrosion resistance as the 18-8 variety is needed, and to some extent in certain chemical installations, etc.

Note from Table I that consumption of wire is quite high, being indicated as 8749 for 1939. The rise in wire consumption has been steady over the past few years. The largest percentage of wire is consumed in the 16-18 per cent chromium classification, with a consumption of 4827 tons indicated for 1939. Free machining variations of this analysis pass through automatic screw machines in considerable quantity for a great variety of parts. The second most important outlet for wire is the 18-8 analysis (302, 304, etc.). These types work-harden rapidly, and go into applications varying from soft weaving wires to very hard spring wires; large quantities of the wire also are cold headed into rivets, screws, etc. Another major outlet is the 12-14 per cent chromium classification, which includes variations such as the 12-2 Cr-Ni type (414) and the 0.10 C, 12 Cr type (410). These alloys can be hardened by heat treatment, and the large tonnage indicated is accounted for by the increasingly popular use of this analysis as spokes in automobile steering wheels, although it is believed some of this consumption has been reported in the 16-18 chromium classification in Table IV.

The survey showed a consumption of 2645 tons of stainless tubing. Much of this went into furniture, into the chemical industries, into marine and aircraft work, etc. A large quantity of this tubing is welded, mostly by the atomic hydrogen arc process, although quantities of hot pierced and cold drawn seamless tubing is sold. The largest percentage of the tubing sold was in the 18-8 classification, which includes variations and modifications for a variety of special corrosion problems. The second major analysis is the 18-30 straight-chromium classification, the bulk of which is nearer the 18 per cent limit.

Stainless Steel Castings

The consumption of stainless steel castings in 1939 was on the order of 9646 tons, which indicates an excellent recovery (58 per cent) from the downswing in 1938, and establishes a new high record for castings, 17 per cent above the previous record year of 1937. These figures are based on returns from an estimated 94 per cent of the consumers and adjusted to 100 per cent consumption.

It is indicated in Table III that the 18-8 analysis of stainless casting is still retaining a fair degree of popularity. This is considered a rather standard composition, and for certain applications involving considerable corrosion about 3 per cent molybdenum is often added. One fairly new application is for manifolds for heavy duty automobile engines. The 18-8 grade is highly resistant to nitric acid solutions, and variations with copper and molybdenum additions are used in applications encountering sulphuric acid.

A greater quantity of tonnage is bulked in the "all other" classification for castings than in rolled steel. This comes from the many special and high alloy analyses being cast today. The 29-9 Cr-Ni analysis is a good example. Sometimes 1 per cent molybdenum is added to this 29-9 class and it is possible to run carbons considerably higher than in the 18-8 analysis. Machinability of 29-9 is considerably better than 18-8, and the former is used a great deal in paper mill work and for heat resisting applications. The 29-9 composition has excellent resistance to intergranular corrosion, and very good strength and ductility. Another analysis in the "all other" group is 15-35 Cr-Ni, which is a popular steel for high temperature work, where neither scaling nor distortion is permissible. Another analysis is 15 Cr, 14 Ni, 1 C, and 3 Si, a rather new and unusual type, which is finding considerable application in valve stems.

Application Distribution

An important section of the blank sent to the 3582 consumers of stainless steel included a request for a distribution of steel as to final outlet, i.e., the automobile, railroad, food processing, chemical, industrial equipment, etc., fields. Most consumers answered this question, although some had difficulty in apportioning total consumption accurately, whereas others had no idea what the final outlet was for their

products. Major classification was easy, however, although quite sizable tonnages had to be thrown into an "all other" group, which included tonnages for which distribution was not known and tonnages going into numerous minor applications as, for instance, cash registers, fertilizer appliers, welding rods, welding equipment and meters, small arms, metal hose, radios, hospital supplies, mailing machines, dental equipment, tennis nets, watch case backs, glue pots, etc.

The distribution of stainless as to final outlet, which is believed to be the

TABLE IV

Production of Finished and Heat-Resisting Steels (1935-1939). Product and Analysis Breakdown

(In Net Tons)

Type of Finished Steel		Analysis Groups, Per Cent Composition†						
		18% Cr & 8% Ni	25% Cr & 12% Ni	12% to 14% Cr	16% to 18% Cr	18% to 30% Cr	All Others (Cr and Cr + Ni)	Total Output, All Analyses
Sheets	1935	6,486	412	1,480	3,253	56	373	12,060
	1936	9,212	943	3,521	3,508	154	269	17,607
	1937	12,652	1,586	3,284	4,562	213	1,223	23,520
	1938	* * *	* * *	* * *	* * *	* *	* * *	17,407
	1939	13,162	105	622	1,705	22	5,891	21,507
Bars and heavy rods	1935	2,279	681	3,340	1,918	121	573	8,912
	1936	4,981	415	4,114	3,552	75	943	14,080
	1937	7,372	1,010	6,361	3,463	121	581	18,908
	1938	* * *	* * *	* * *	* * *	* *	* * *	13,223
	1939	3,735	952	4,505	3,421	66	12,103	24,782
Strip (hot and cold rolled)	1935	5,504	736	1,312	1,504	316	1,175	10,547
	1936	9,550	488	3,886	2,538	118	148	16,728
	1937	8,611	236	6,211	5,100	73	352	20,643
	1938	* * *	* * *	* * *	* * *	* *	* * *	15,928
	1939	25,769	1,381	479	11,761	17	930	40,337
Tubular goods	1935	592	114	312	252	328	210	1,808
	1936	621	108	609	360	40	86	1,824
	1937	1,016	34	407	394	383	1,518	3,752
	1938	* * *	* * *	* * *	* * *	* *	* * *	2,087
	1939	1,282	34	22	102	363	842	2,645
Plates and shapes	1935	1,203	26	586	101	11	126	2,053
	1936	1,109	126	447	751	32	96	2,561
	1937	1,156	325	420	108	88	228	2,325
	1938	* * *	* * *	* * *	* * *	* *	* * *	2,864
	1939	924	94	88	165	22	605	1,898
Wire and light rods	1935	1,982	102	368	301	4	473	3,230
	1936	713	201	1,616	885	86	230	3,731
	1937	1,241	205	908	880	114	514	3,862
	1938	* * *	* * *	* * *	* * *	* *	* * *	3,522
	1939	2,157	55	1,429	4,827	50	231	8,749
Forgings	1935	553	122	773	576	20	226	2,270
	1936	1,889	482	792	71	69	338	3,641
	1937	735	115	862	778	128	223	2,841
	1938	* * *	* * *	* * *	* * *	* *	* * *	1,799
	1939	297	1,931	2,239	33	41	101	4,642
Total (by analysis)	1935	18,599	2,193	8,171	7,905	856	3,156	40,880
	1936	28,075	2,763	14,985	11,665	574	2,110	60,172
	1937	32,783	3,571	18,453	15,285	1,120	4,639	75,851
	1938	* * *	* * *	* * *	* * *	* *	* * *	56,833
	1939	47,326	4,552	9,384	22,014	581	20,703	104,560

GRAND TOTAL, all finished steels, all analyses—for 1935 = 40,880 net tons.
—for 1936 = 60,172 net tons.
—for 1937 = 75,851 net tons.
—for 1938 = 56,833 net tons.*
—for 1939 = 104,560 net tons.‡

*No separate breakdown available. Total figure for 1938 from American Iron and Steel Institute.

†Analysis groups are approximate; in several classifications each element may vary as much as ±2 per cent from the range shown, or may include small percentages of other elements such as molybdenum.

‡From THE IRON AGE consumption survey for 1939, described in text.

first complete breakdown of this type, tallied up as follows:

AUTOMOTIVE: (Includes gas and Diesel engines, buses, tractors and trucks.)	= 37.8 per cent
FOOD HANDLING: (Includes restaurant equipment, dish washers, meat, beer, milk and yeast handling machinery and equipment.)	= 11.4 per cent
TRANSPORTATION: Other than automobiles; includes trains, boats, airplanes, naval vessels.)	= 11.3 per cent
CHEMICAL EQUIPMENT: (Includes soap, pulp and paper, petroleum equipment.)	= 6.3 per cent
MACHINERY: (Includes machine tools, pumps, turbines, textile machinery, etc.)	= 5.7 per cent
HOUSEHOLD EQUIPMENT: (Includes stoves, furniture, beds, pots and pans, etc.)	= 3.5 per cent
BUILDING CONSTRUCTION: (Includes building decoration, signs, fans and blower equipment, plant maintenance, etc.)	= 1.6 per cent
ALL OTHER: (Includes non-allocated steel.)	= 25.1 per cent

It will be noticed that by far the largest single user of stainless steel is the automobile industry, which accounted for about 37.8 per cent of the total consumption of all alloys. Hundreds of tons of this material go into body trim, large quantities go into steering wheel spokes, large tonnages go into hub caps, gas tank caps, radiator grilles, miscellaneous hardware, etc. The motor car industry is gradually using larger quantities of stainless each year, but the higher price of stainless as compared with chromium plating is keeping applications from being as widespread as the makers would like. Recently there has been a tendency in the automobile industry to use thin stainless facing snapped over heavy carbon steel backing to reduce costs. This has for some time been standard practice with body trim and is a growing practice for hub caps, etc.

The second major outlet for stainless is the food processing and handling fields. There are at least ten times as many individual consumers of stainless in this field as in any other, including the automobile industry but, of course, the consumption of any one food equipment maker is much smaller than any one of a number of auto-part builders. Stainless is superior to glass in sanitation, is free of toxic elements, and does not affect the taste, color, odor or compositions of food or milk products. In this field the application of stainless steel has grown despite cost. Nonetheless, users seem to be particularly annoyed by high prices and are very keen for developments like clad steel for processing equipment, and stainless backed up with composition (like Ludlite) for counter equipment, etc.

The third largest consumer of stainless is the transportation industry (other than automobiles) which accounts for 11.3 per cent. This includes trains, airplanes, boats, etc. Chief of these, of course, is the railroad industry. The new streamlined trains have caught the public's fancy, and by excellent service, high speed and luxurious accommodations much lost traffic is being recaptured. Some of these trains are only trimmed in stainless, others have the body structure of stainless, and some are practically of stainless construction throughout, including the trucks and understructure. Weight is reduced sometimes by as much as 40 per cent. The aviation industry also is a growing user of stainless, although not growing as fast as the stainless makers would like. For some time, stainless in aircraft was pretty much limited to exhaust manifolds and firewalls, but recently whole fleets of ships have been built with all movable tail surfaces and ailerons of stainless, and some ships have been built with entire wing sections made of stainless. The latest advance in this field has been several amphibians made of stainless throughout. Chief advantages of stainless in aircraft are its high melting point and its great resistance to oxidation at elevated temperatures. With stainless it is also possible to use stitchwelding which can be done at the rate of 1000 welds a minute, as opposed to riveting for non-ferrous metals, which cost from 3c. to 5c. apiece.

Recently certain producers have buried their competitive differences and are engaged in a common effort to help the aircraft makers in technical problems involved in the use of stainless steel, and much is expected from this action. Also of interest is the development work being done on the Rhon mill in Cleveland for turning out very wide stainless sheet at thicknesses of a few thousandths and at tensile strengths about 200,000 lb. per sq. in. This metal is in much demand and is being increasingly used in military aircraft.

About 3.5 per cent of stainless steel went into household equipment in 1939, which field is becoming increasingly important because of the public's recognition of the metal's beauty and durability. It is used a great deal in flatware, in pots and pans, in stoves, on and in refrigerators, etc. With the recent development of stainless-clad pots finished in various ways on the outside (copper plated as by Revere, vitreous enameled, etc.), the application in this field is expected to grow steadily.

Stainless also is used for chemical equipment (6.3 per cent), and in vats and pipes handling pharmaceuticals, glues, explosives, leather, lacquer, liquor, rubber goods, textiles, paper and pulp, soap, etc.

The Year Technically

Metallurgical investigation showed pronounced vigor in 1939. Most significant was the introduction and growing acceptance of electrochemical polishing as a finishing operation, particularly for articles which cannot be handled on a wheel. Certainly, this finishing technique will be reflected in greater application of stainless. There are a number of competitive processes, all of which have been described in THE IRON AGE. One is sponsored by Allegheny Ludlum Steel Corp., another by Rustless Iron & Steel Corp., another by Battelle Memorial Institute, and a fourth—under the direction of Sam Tour—is described later on in this issue.

Although several varieties of stainless clad onto mild steel have been available for many years, the past year witnessed much publicity on two new processes. The first to hit the headlines was the Kinkead method, which had a resurgence of popular interest sometime after being described in the industrial press as, for instance, in the Feb. 16, 1939, issue of THE IRON AGE. Kinkead piles low-carbon ferrochromium broken down to 10 mesh; together with nickel shot; and molybdenum, columbium, manganese or other additive element, on top of a carbon steel slab. This is covered with waste slag from an electric furnace, together with some sand and calcium fluoride. The slab, stainless steel ingredients, and slag are heated in a furnace to about 1470 deg. F., after which a carbon arc traverses the surface and fuses the mass to the slab. Steel clad with stainless has been made this way, but so far as the writer knows the material is not being turned out commercially. It would seem that considerable slag and stainless steel would have to be ground off before firm metal is reached, and there would possibly be non-uniformity in the stainless metal. In any case, if excellent stainless steel can be so made out in the open under a carbon arc, the writer is rather curious to know why metallurgists have been yelling so much over the past decade regarding the difficulties and skill needed in making stainless in an electric furnace, where all variables are under close control.

Quite revolutionary changes have

been visualized for this process as, for instance, the displacement of tin plate, galvanized steel, etc. This, however, seems more than unlikely for some time to come.

More recently Allegheny Ludlum Steel Corp. has announced operation of the Pluramelt process, a compositing procedure originally developed by M. W. Kellogg Co., Jersey City, N. J., under the direction of R. K. Hopkins (patents No. 2,191,482 and No. 2,191,469, and others).

A quite large specially designed type of electric arc melting furnace, differing radically from conventional types, is being used at Brackenridge, Pa., for this operation. Part of the carbon steel and the stainless steel components are brought to a molten stage and intermelted into a firmly alloyed unit mass. The furnace itself is quite unique, in that it combines the function of steel making and of mold. Pluramelt has been produced in single-faced and double-faced sheets and plates, and faced wire, all in a variety of analyses. These products stand up very well under severe physical testing, and much is expected of it market-wise.

Although stainless-faced mild steel has never seemed to catch hold in this country, it would seem that there should be an expanding market. Some producers are not particularly enthusiastic in view of the necessity of carrying duplicate inventories and are of the opinion that for thin sheet and strip (where the large consumption is) the cost differential between clad and solid material would not be great. Admittedly, however, for plates, etc., the clad material offers considerable advantage where stainless characteristics are needed only on one side, as for instance for tankers carrying oil and gasoline.

Even on the thin material, however, the writer is of the opinion that considerable advance will be made, albeit rather slowly. And, rather than reduce stainless consumption, such clad material would likely increase it substantially. In the cooking utensil field for home use, particularly, the high cost of the articles have kept sales down, and clad material may be the key to reduce costs and at the same time improve the product by minimizing the tendency for hot spots and improving heat transfer. Stainless-clad material is being made up into cooking utensils, with the outside vitreous enameled or finished in some other manner, and the performance of these articles is said to be extremely encour-

Buyers of Stainless Alloys Want

(1) Lower prices: More than 1000 buyers are convinced that lower prices are very necessary before stainless alloys will assume their proper stature. The statements appeared to be not so much conventional consumer plaints, but rather deep-rooted convictions that manufacturers should be disabused of their idea that stainless offers great production difficulties which are used to justify excessive prices.

(2) Improvement in mill deliveries: Over 300 consumers complained that manufacturers carry too slim stocks or at least are extremely negligent in the handling of orders and fulfilling shipping promises.

(3) Reduce number of types: Many consumers complain that every time a new problem arises that mills devise another trade name. The desire is for stainless to be sold in eight or ten major analysis groups rather than by trade name.

(4) "Quantity extras on small lots too high."

(5) "Closer control of size and gage tolerances to reduce rejections."

(6) "Sheets with No. 4 finish on both sides."

(7) "Wire without cast." . . . "Put up wire in heavier coils." . . . "Remove drawing curl from wire as it costs **$2** a lb. to straighten."

(8) "Quick means of identification."

(9) "High pressure tubing from stainless other than 18-8 analysis."

(10) "More conservative advertising so that claims are more nearly in line with performance." . . . "Much corrosion resisting data must have been compiled by someone doing a lot of wishing or hoping."

(11) "Finish on sheets comparable with finishes available on strip."

(12) "Development of an alloy more resistant to corrosion than Cor-Ten, Zoloy, etc., but less so than the present stainless alloys—to sell at a base price of around 10c. per lb."

(13) "More complete physical data on alloys used at elevated temperatures."

(14) "Much progress has been made in welding and soldering, but additional data badly needed."

(15) "Alloys more resistant to hydrochloric acid and chlorides than the present ones containing molybdenum."

(16) "Very difficult to secure analysis 18 Cr, 8 to 10.5 Ni, 2.75 to 3.5 Mo, and 0.08 C."

(17) "Grades such as 302, 303, 304 and 416 vary too much in hardness and machinability from lot to lot (various purchases), and more standardization and closer control are needed."

(18) "More detailed data on welding and annealing."

(19) "Closer standardization of plate and sheet finishes among all manufacturers."

(20) "More equitable pricing between various types of 18-8 alloys, i.e., 304-316, 309-347, 317-316, etc."

(21) "Better surface on cold rolled strip to reduce grinding and polishing costs."

(22) "Furnish round stainless steel bars in shafting sizes, as do makers of carbon steel bars."

(23) "Brighter finish on chromium-nickel alloys to reduce buffing costs."

(24) "Lower polishing extras."

(25) "Improvement in 18-8 grade to prevent pit corrosion."

(26) "Improvement in and more uniform temper and finish. Improve ductility."

(27) "Improve alloys in order to get greater resistance to salt brine."

(28) "Beaded edge or molding so that nails or screws can be used to fasten sheets in architectural construction without reflections being wavy or distorted."

(29) "Increase educational advertising to special users."

aging, and they are most attractive. This could well be the answer to the young Englishman who stood outside a London window display of stainless ware and said to his wife: "Very nice indeed, but not for the likes of us. Look at the prices—a guinea for a colander!"

During the year a Mid-West steel producer experimented extensively with the Head-Howe process (Messrs. Corbett, Howe and Associates, consulting mining and metallurgical engineers, Montreal, Canada), which is said to be a simple means of alloying a steel bath with chromium direct from (low-grade) ore, applicable to the production of either low or high chromium content steels, in either basic open hearth or basic electric furnaces. What the results have been to date, the writer does not know. The Feild process of Rustless Iron & Steel Corp., used for a number of years, also uses low-grade chromium ores for direct transfer of chromium to a steel bath in an electric furnace.

In England Digby is carrying on research work on chromium-copper "Cypritic" stainless alloys (see THE IRON AGE, Oct. 14, 1937, for metallurgical data), and it appears that shortly a plant will be in production on this unique nickel-less stainless alloy.

And, as usual, the Japanese came through with a couple of revolutionary processes during the year. Dr. Masayoshi Tagaya, of Osaka Imperial University, uses a high frequency method of fusing an alloy of 15-20 chromium and 10-15 per cent nickel, remainder iron, to secure a "very high grade stainless alloy." A similar method has been used to secure an 8-18 chromium, 10-20 manganese alloy, also of "great corrosion resistance." Japanese newspapers predict a metallurgical revolution. The Nippon Nickel Co., Gumma prefecture, claims also to be commercially using a direct rolling process (see THE IRON AGE, April 4, 1940) for producing 40-ft. lengths of 12-in. strip direct from molten metal, at the rate of over 100 tons per month; 13-1 Cr-Ni and 18-8 Cr-Ni analyses have already been rolled by such methods. Worth while details are conspicuously absent, however, in accordance with conventional Japanese reticence regarding anything they are doing.

New Capacity

In view of the constant improvement in stainless steel demand, a number of producers in this country have seen fit to increase or revamp production facilities. Republic Steel Corp. opened a large modernized finishing plant a few months ago at Massillon, Ohio, with a potential output of 1500 tons monthly in prospect. (See THE IRON AGE, Feb. 29, 1940.) Rustless Iron & Steel Corp. is currently initiating production in a $1,500,000 plant addition, providing for rapid, straight-line and highly efficient production and finishing of bars and wire. A new furnace is also being added to lift capacity to 55,000 tons yearly. Capacity for certain of the finished products will be approximately doubled, and additional capacity can be added when needed with a minimum of disorganization. The United States Steel Corp. has added to production facilities. Crucible has installed an additional electric furnace at Midland, and three more are in prospect. Superior Steel Corp. has added a 30-in. cold mill for stainless strip. Universal-Cyclops has for some time been operating its new semi-continuous hot mill for stainless, together with new cold rolling, pickling and polishing equipment. And Allegheny Ludlum is increasing the capacity of its foundry division at Buffalo (see THE IRON AGE, Jan. 28, 1937, for description of this hollow-electrode electric furnace process); has added new heat treating furnaces, straightening machines for rounds up to 5 in., and a Rotoblast unit for descaling at Watervliet; is now initiating new construction at Dunkirk to double the capacity for fine wire; has installed a new Steckel rolling mill, rebuilt and modernized a 29-in. 4-high mill at West Leechburg; and has just installed what is believed to be the largest roller leveler for stainless at Brackenridge. And quite likely there are still other additions with which the writer has not come in contact.

In all, it would appear that stainless steel producers view the future with confidence, and from the record of the past year this attitude is fully justified.

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WORK POSITIONERS REDUCE WELD FABRICATION TIME

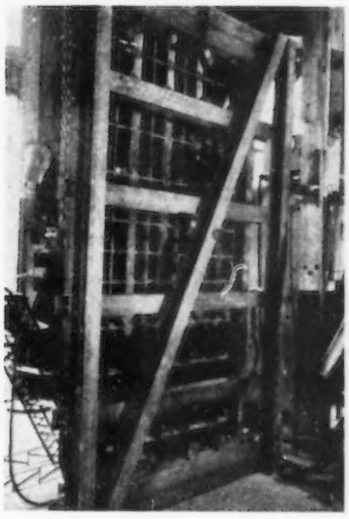

FIG. 1—Trouble with warpage in fabricating this foundry shakeout grating prompted a study which resulted in a marked reduction in welding and cleaning time.

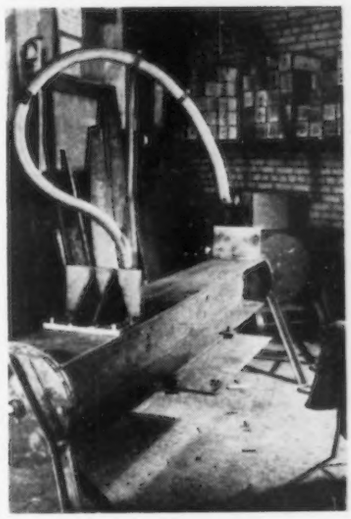

FIG. 2—Simple welding fixture composed of a 12-in. H-beam pivoted at the ends to place work in longitudinal position.

BECAUSE of considerable trouble with warpage in its weld-fabricated foundry shakeout gratings (Fig. 1), the Simplicity Engineering Co., Durand, Mich., manufacturer of high-speed foundry shakeouts and of screens for foundry and other uses, re-studied its set-up and procedure for welding. This brought about the installation of work positioning equipment and other aids to welding, which resulted in reducing by half the welding and cleaning time.

Prior to the study use was made of stationary frameworks to which structural parts were clamped during welded fabrication. Investigation and experiment revealed that a properly designed welding fixture together with correct sequence of welding would not only reduce warping to a minimum but would also permit placing the work so that all of the welding could be done in a flat, downhand position.

A typical example of a simple welding fixture which this company developed to avoid warpage in the welding of different jobs is pictured in Figs. 2, 3, and 4. This fixture is made of a 12-in. H-beam arranged to pivot at the ends to permit turning the work in any horizontal position. A special feature of this fixture, which can be seen in Fig. 3, is the facility for attaching a plate to one side of the H-beam to provide a table for the welding of small parts.

Further savings were in the direction of weld cleaning time, accomplished by means of a special compound which reduces the tendency of weld splatter to adhere to the welded work. This compound, furnished by the Lincoln Electric Co., is applied with an ordinary paint brush to the joint and adjacent surfaces before welding begins, and only sufficient solution is necessary to cover the surface of the work in the spatter zone. The film provided by this compound is said to have reduced cleaning time from 20 to 60 per cent, depending on the nature of the work.

A further aid to the company's welding operations was in lessening operator fatigue and interruptions by means of a Linconditioner, a machine designed to filter dust particles from the air in the vicinity of the welding work and to eliminate discomfort from the smoke of welding. Drawn into the machine through a nozzle placed near the point of welding (Fig. 4), the smoke passes through a flexible tube to a filtering material in the base of the machine, which removes approximately 95 per cent of the dirt particles from the air in the vicinity of the welding arc and carries away considerable heat, thus making for more favorable conditions for the operator.

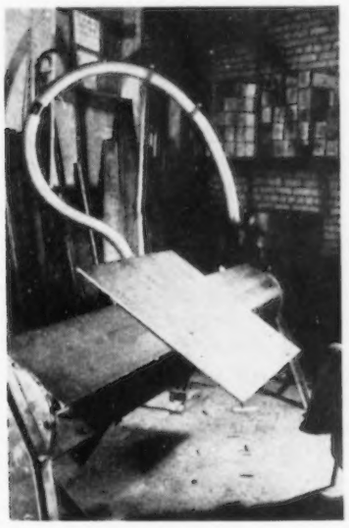

FIG. 3—A plate clamped to the beam of the fixture provides a table for welding of small parts.

FIG. 4—An air-filtering machine serves to carry smoke and heat away from the operator.

PHOTOELASTICITY *As Applied to* DESIGN PROBLEMS

By O. J. HORGER and T. V. BUCKWALTER
Chief of Railway Engineering and Research, and Vice-President Respectively, Timken Roller Bearing Co.

IF a machine member must have one groove, it may be stronger if several grooves are used; an annular groove near a press fit increases fatigue strength; bolts are stronger by removing metal. By photoelasticity many design changes such as these are indicated. This article explains photoelastic analysis in understandable language, and indicates many design changes in machine parts which give improved stress distributions.

PHOTOELASTICITY provides a photographic method of showing the distribution and magnitude of stresses produced in structural and machine parts under load.

Failure of a design part usually occurs in a region of localized stresses or stress concentration. Sometimes the often practiced procedure of making the part larger is not permitted because of space and weight limitations, and if such increase should be permissible the requirement of maximum strength at minimum cost and weight remains a competitive factor. Certainly, a more satisfactory method would be to change the shape of the member in the region of high stress concentration so as to reduce the highly localized stresses which lead to weakness.

Satisfactory analytical solutions do not exist for the calculation of stresses in many design problems. This lack of knowledge necessitates a questionable factor of safety when an engineer attempts to alter the shape of a member to give minimum stress concentration. In this respect the photoelastic method often enables the designer to *quickly locate the regions of localized stresses and indicate alterations in the design to give a lower maximum stress and more uniform distribution.*

Photoelastic investigations have mostly been limited to the study of stresses in two dimensions, that is, where the loads are acting in the plane of the design part. But many problems occur in three dimensions, and such types often may be handled by selecting a slice through the member for two dimensional study. In such cases, while the results are of considerable significance, they are generally of a qualitative value in that they afford the engineer a better understanding of the problem under consideration and suggest what improvements may be made. As an example, the specific problem of journal fillets on axles was studied by two dimensional photoelastic analysis and gave good agreement with strain gage measurements on actual fillets of axles.[1] Some recent progress has been made in three dimensional stress analysis,[2] but the following paper deals only with the aspects of two dimensional studies.

A model of the design part to be studied is machined from a flat piece of some isotropic transparent material such as Bakelite, Marblette, or other similar material. The model is loaded in a manner to simulate service conditions. When polarized light from a

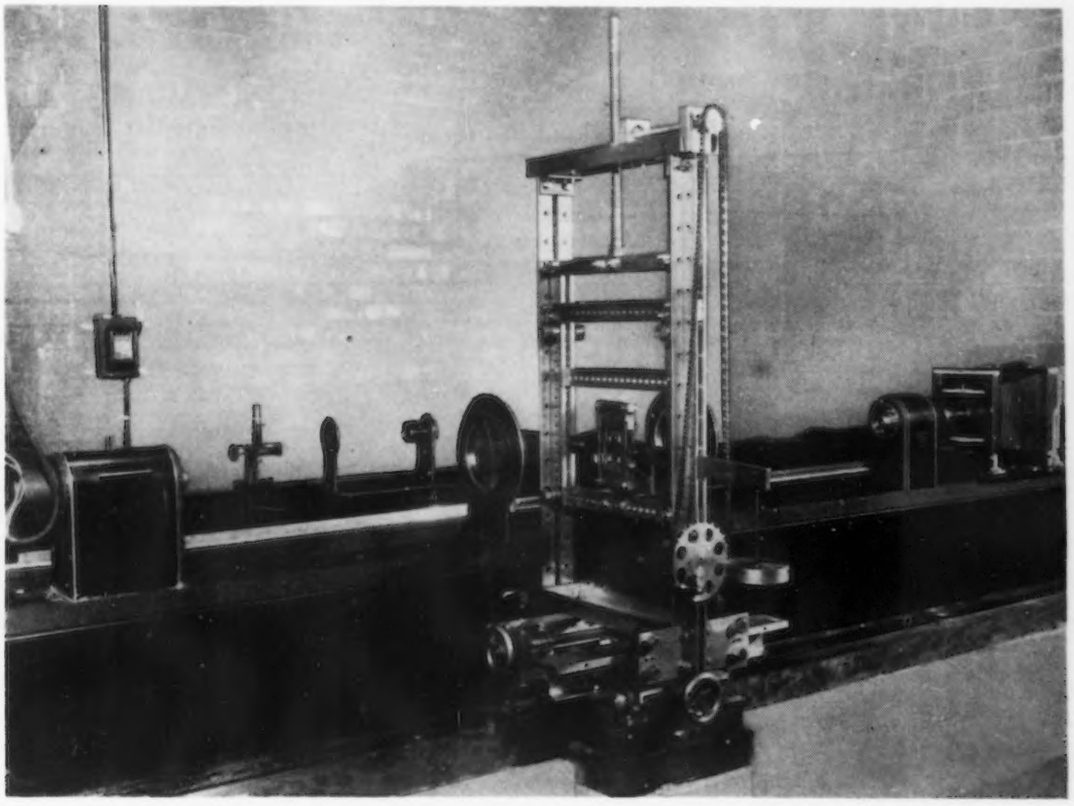

FIG. 1—Optical equipment and set-up used to make photoelastic studies.

mercury vapor lamp is passed through the stressed model each element of the model acts as a double refracting crystal. An interference effect is produced to obtain the projected image similar to the accompanying photographs showing a series of black and white bands or fringes spaced one wave length of light apart. These bands indicate the magnitude and distribution of shearing stress in the model. The magnitude of the stress is proportional to the order number of the interference bands and each fringe passes through points in the model which have the same value of shearing stress.[3]

The use of such plastic models to replace actual members, which may be of steel, often leaves some question with the engineer as to the validity of the results. This feeling is not justified, however, when it is considered that the stress distribution in simply connected bodies remains the same regardless of the elastic constants so

[1] R. E. Peterson and A. M. Wahl, "Two and Three Dimensional Cases of Stress Concentration, and Comparison with Fatigue Tests," Jr. App. Mech., Trans. A.S.M.E., 3, A-15 (1936).

[2] M. Hetenyi, "Application of Hardening Resins in Three-Dimensional Photoelastic Studies," Jr. of Applied Physics, Vol. 10, No. 5, May, 1939.

[3] Technical aspects of Photoelasticity with extensive bibliography is given by R. D. Mindlin, "A Review of the Photoelastic Method of Stress Analysis," Jr. of Applied Physics, Vol. 10, Nos. 4, 5, April, May, 1939.

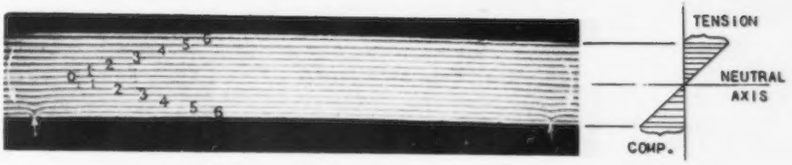

Fig. 2A—Uniform beam in pure bending.

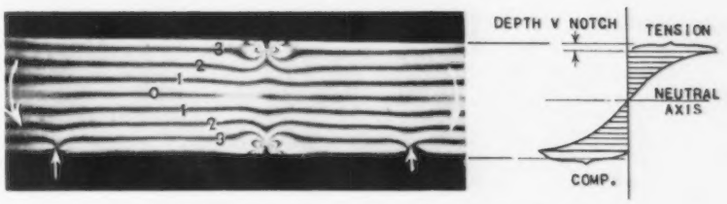

Fig. 2B—Single notched beam in pure bending.

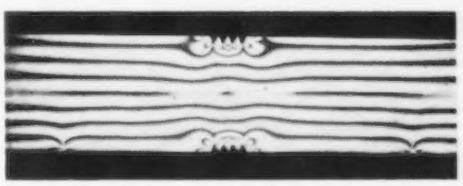

Fig. 2C—Multiple notched beam in pure bending.

FIG. 2—Photoelastic studies showing stresses and their distribution in simple beams.

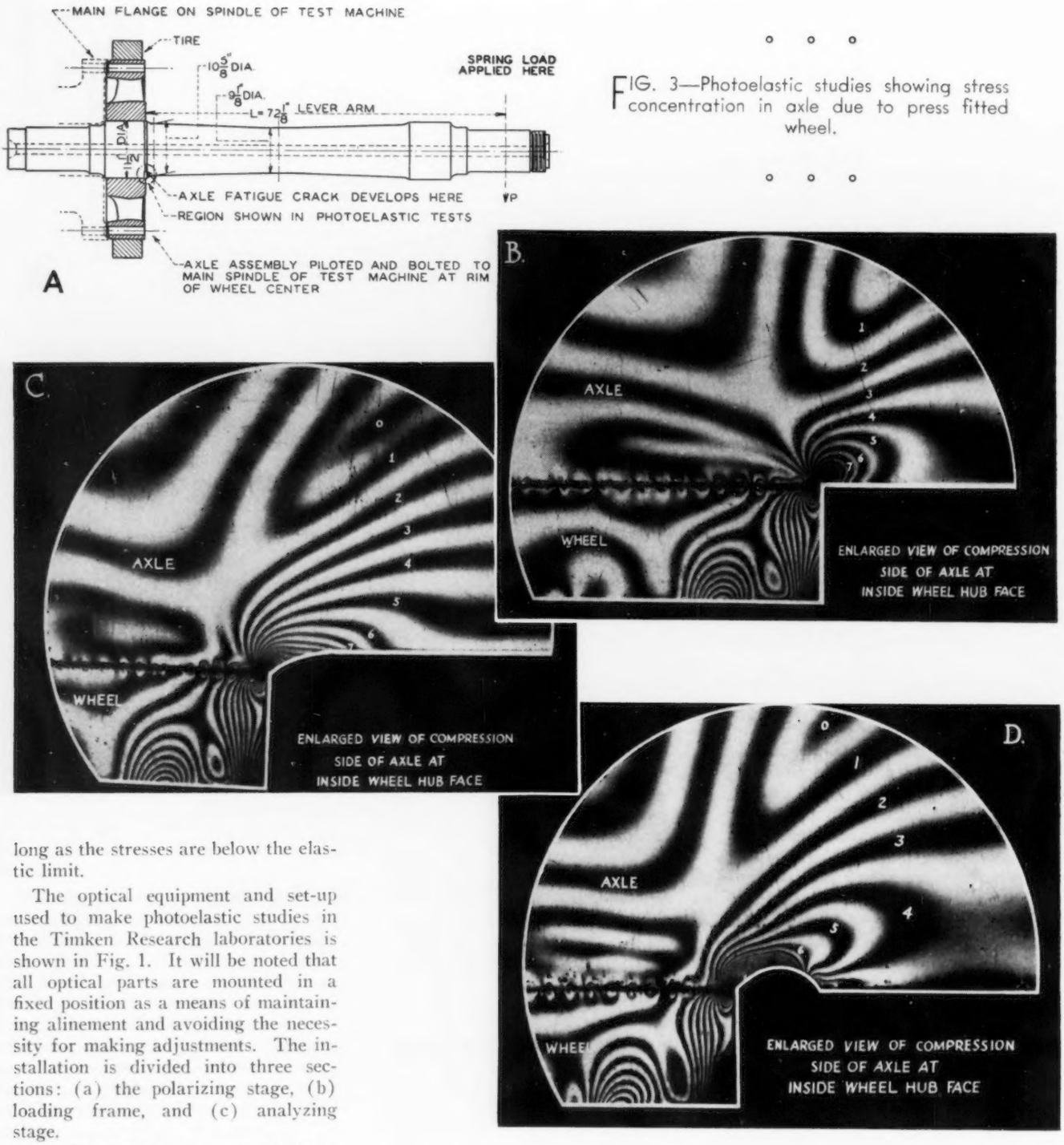

FIG. 3—Photoelastic studies showing stress concentration in axle due to press fitted wheel.

long as the stresses are below the elastic limit.

The optical equipment and set-up used to make photoelastic studies in the Timken Research laboratories is shown in Fig. 1. It will be noted that all optical parts are mounted in a fixed position as a means of maintaining alinement and avoiding the necessity for making adjustments. The installation is divided into three sections: (a) the polarizing stage, (b) loading frame, and (c) analyzing stage.

The polarizing stage located in front of the loading frame includes, from left to right, a light source, condensing lens, water cell, turret head containing various filters, 15-mm. square Glan Thompson prism mounted in 360 deg. graduated and rotatable mount, and quarter-wave plates in graduated and rotatable mount which is hinged so that it may readily be swung in or out of the optical path. A 7-in. diameter field lens of a plane-convex type is shown adjoining the loading frame. A high intensity mercury arc light source is shown, but a 15-amp. carbon arc lamp is also available to interchange with the mercury light.

The loading frame is adjustable in three directions and is designed to receive various types of models for study. Provisions are made for applying various types of loads to the models. The model shown in position is the one discussed later herein under the subject of press fits.

The analyzing stage includes the 7-in. diameter field lens which is an achromatic doublet to remove color and distortion. This is followed by a single housing in which is mounted quarter-wave plates and analyzer prism which are duplicates of those in the first stage, a 4-in. lens, and finally a revolving mount containing a 3-in. lens for unity magnification of the object and a micro-lens for four-times magnification. A standard 8x10-in. view camera is shown for taking a photograph of the image.

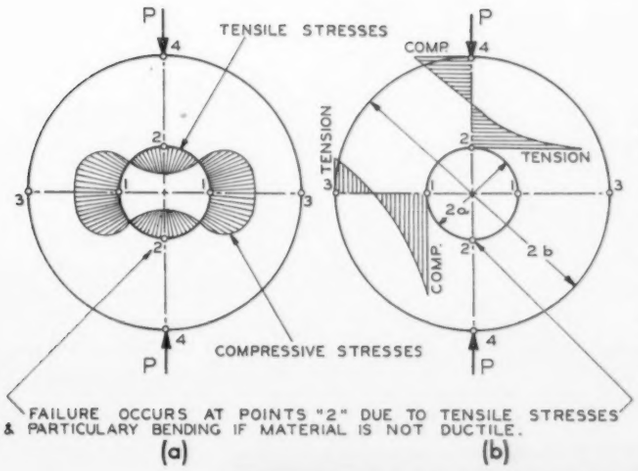

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FIG. 4—(a) General system of tangential stresses around hole; (b) stress at critical sections: maximum value of stresses at points 1, 2, 3, and 4 may be calculated from curves in Fig. 6.

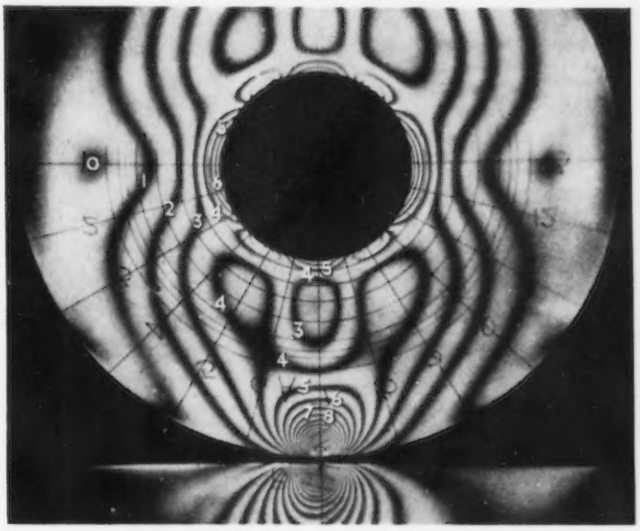

FIG. 5 — Photoelastic study of hollow cylinder loaded as in Fig. 4.

Many types of photographic studies may be made and their detailed analysis is involved and beyond the scope of this article. It is proposed here to show some simple illustrations which will permit the practicing engineer to evaluate certain essential characteristics.

A typical photograph of a uniform beam in pure bending is shown in Fig. 2a. The black fringes represent lines of equal maximum shearing stresses, that is, each fringe runs through points where the shearing stress is the same. It will be noted that the fringes are straight, parallel, and uniformly spaced. The fringes are numbered with the neutral axis marked zero. On each side of the neutral axis the fringes are numbered 1, 2, 3, etc., up to the boundary of the beam. The shearing stress is directly proportional to the fringe number. This example conforms with the elementary theory of bending stresses in beams where the stress at any point is calculated as being proportional to the distance of the point from the neutral axis.

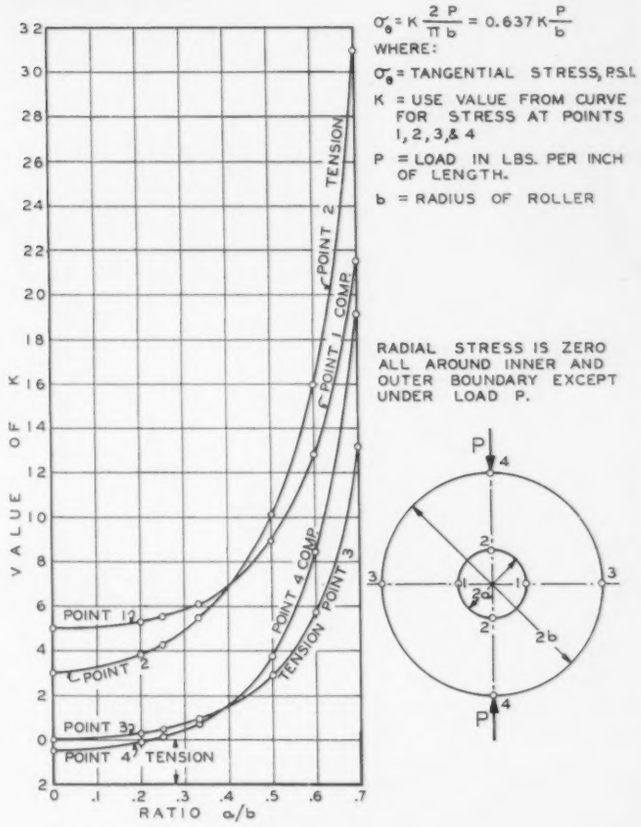

FIG. 6—Value of K for calculation of critical stresses in hollow cylinders for various values of a/b.

The case of a V-notched beam is shown in Fig. 2b, and enables an engineer to associate the appearance of the fringe pattern with a condition of well appreciated physical weakness due to the V-notch. The region of the notch shows fringes which have sharp curvatures and close non-uniform spacing—this is an indication of stress concentration. Such regions are a source of weakness in the design of any member and the desired fringe pattern is one of uniform stress similar to Fig. 2a, which distribution is known to give maximum strength in bending. One of the objects of making photoelastic tests is to determine the magnitude of these maximum local stresses and then change the design to reduce this effect of stress concentration to obtain greater strength. To obtain the stress concentration due to the notch in Fig. 2b, it is only necessary to divide the fringe number adjoining the base of the notch (say 8) by the fringe number at the boundary of the beam when there is no notch (say 4) which gives a stress concentration factor of 2. This means that the use of the notch introduces a stress in the beam twice as high as if no notch were used in the same beam.

So far only shearing stresses have been mentioned as being ascertained from the fringe photographs. In fatigue problems the maximum shearing stress is often used as a criterion of

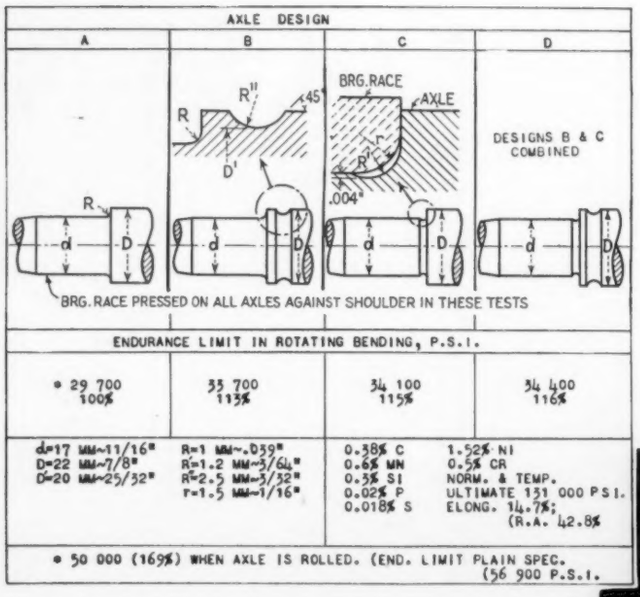

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FIG. 7 — Examples of where the addition of a new notch increases the fatigue strength of axles in rotating bending. (By A. Thum.)

o o o

strength of the material. Under the action of variable or impact loads, however, such stress concentration factors represent safe values but are often too large, especially for ductile materials. Additional knowledge of the influence of "size" of the member and the "sensitivity" of the material to stress concentration must be available to safely use factors lower than the photoelastic values. Laboratory tests of real members under the action of repeated or impact stresses are necessary for this further determination of

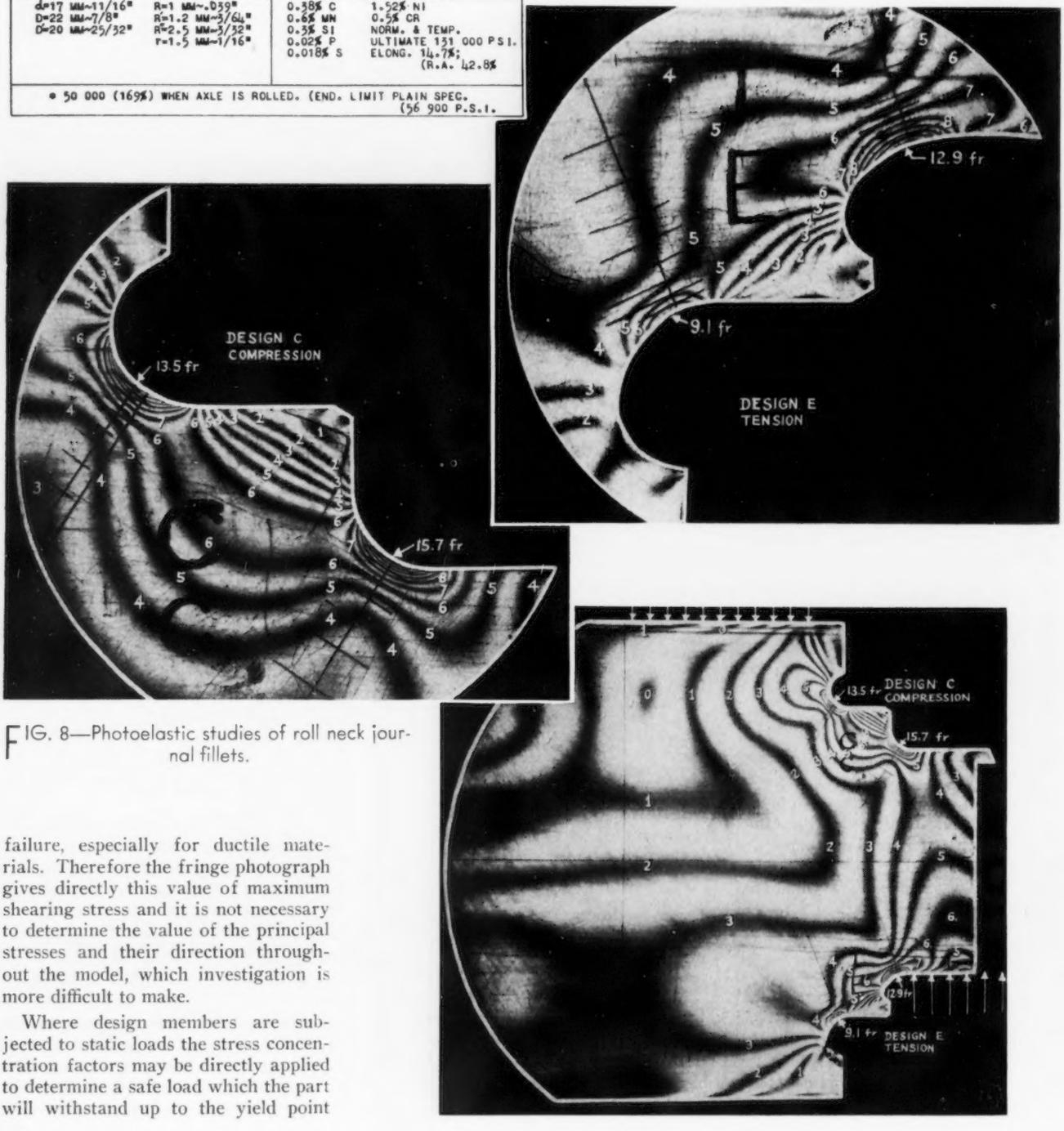


FIG. 8—Photoelastic studies of roll neck journal fillets.

failure, especially for ductile materials. Therefore the fringe photograph gives directly this value of maximum shearing stress and it is not necessary to determine the value of the principal stresses and their direction throughout the model, which investigation is more difficult to make.

Where design members are subjected to static loads the stress concentration factors may be directly applied to determine a safe load which the part will withstand up to the yield point

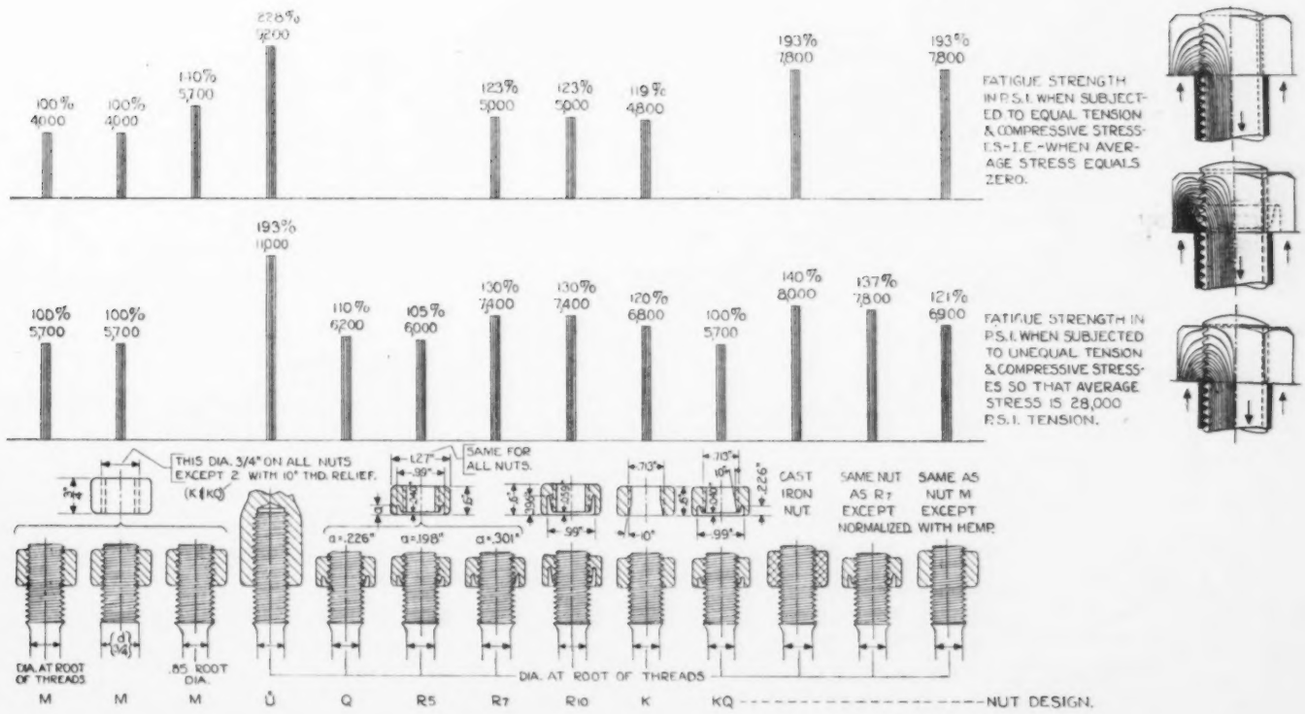
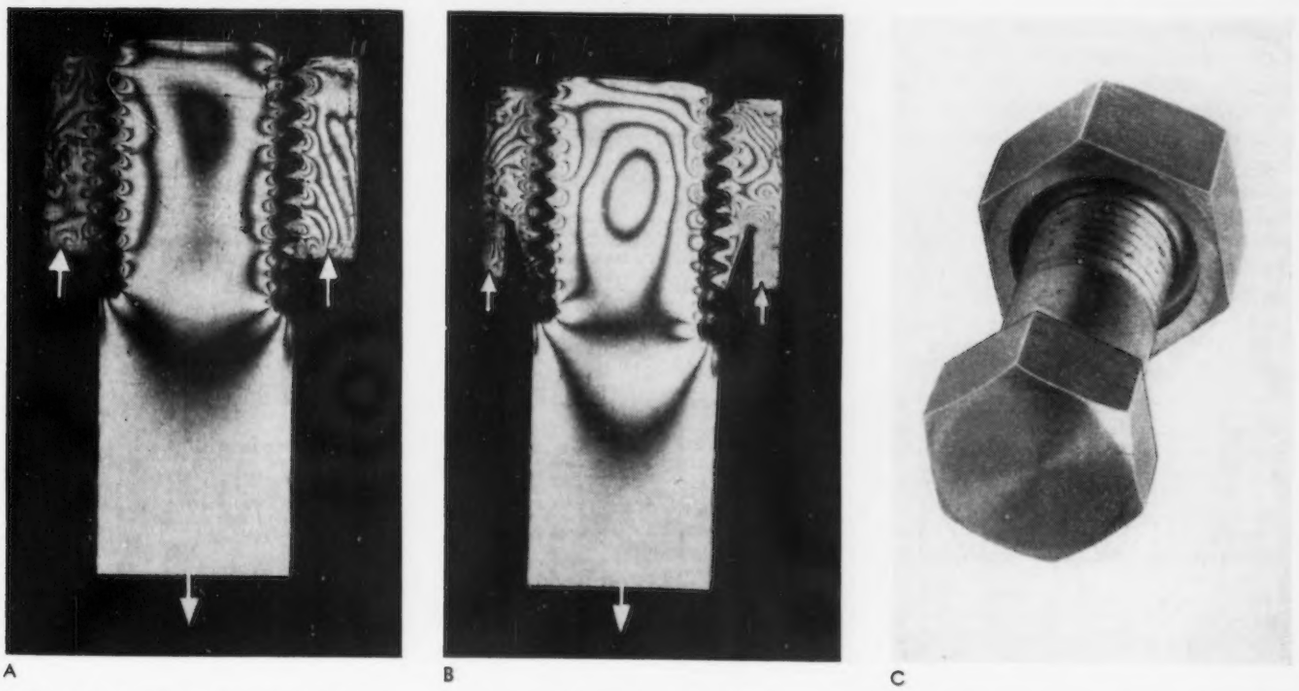


FIG. 9—Fatigue strength of various threaded joints. (By Wiegand.) All nuts hot pressed unless otherwise noted. Bolt iron analyzes 0.06 C, 0.51 Mn, 0.077 P, and 0.036 S; tensile strength = 61,000 lb. per sq. in., yield point = 41,000 lb. per sq. in., and elongation = 31 per cent, with 69 per cent reduction in area.

the actual stress concentration present. When the design members are large or the "sensitivity" factor approaches the photoelastic value as a limit, this procedure, in the absence of more detailed data, represents good design practice.

Photoelasticity gives the stress concentration due to shape and the influence of other conditions, such as corrosion, cannot be ascertained from this method. In any case only stresses within the elastic limit may be considered.

For the above reasons photoelastic tests are often used to correlate and supplement tests of actual design parts. Some examples of design problems given here show this correlation. A small number of some important prob-



A B C

FIG. 10—Photoelastic studies of nut and bolt assemblies. At left, A, fringe photograph of conventional nut and bolt assembly. B, center, same as in A, but with relieved nut. C, photograph of nut and bolt in B.

lems developed by various investigators are briefly summarized as follows:

Press fitted assemblies are frequently used in engineering practice. It is seldom realized, however, that due to the press fit the fatigue strength of the axle is greatly reduced below that of the usual plain beam specimen without a fitted member. This tremendous weakening effect has been investigated by both photoelastic methods and fatigue tests.

A design of press-fitted wheel and axle assembly often used is shown in Fig. 3a. Axle fatigue cracks develop within the fit near the inside wheel hub face which is the region indicated in Fig. 3a by the dotted circle. Photoelastic studies were made in this region for three different axle designs as shown in Fig. 3b, c, and d. Fig. 3c and d could be interpreted as representing an axle construction with higher fatigue strength than that shown in Fig. 3b. The quantitative value of this improvement cannot be determined from photoelastic studies since factors other than shape enter into this problem, such as mechanical abrasion or molecular attrition between the fitted surfaces. Results of fatigue tests on 2-in. to 7-in. diameter axles tested as rotating cantilever beams gave a definite comparison for allowable stresses in the wheel fit portion, as shown in Table I. While wheels have been shown as being pressed-on the axles, a similar weakening effect of the axle is produced by any kind of pressed-on member when the axle is subjected to variable stresses.

On the basis of these tests steam

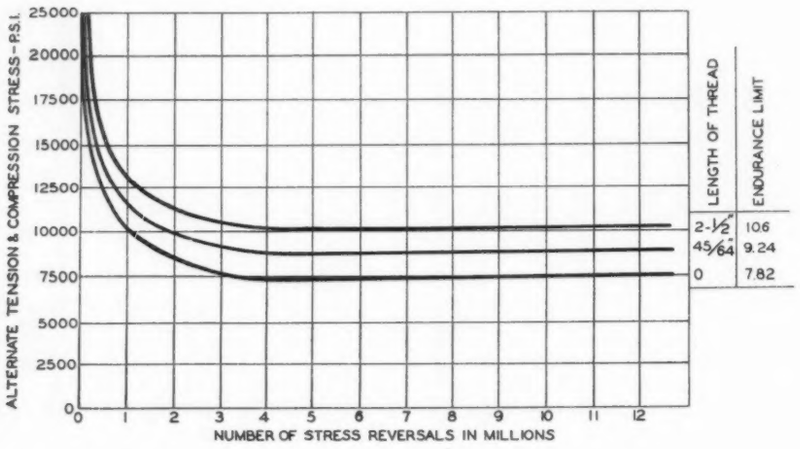


FIG. 12—Effect of length of free threads under nut, per Fig. 11, on the alternate tension-compression fatigue limit of bolts. By Staedel. Bolt material with 61,000 lb. per sq. in. ultimate strength and 41,300 lb. per sq. in. yield strength.

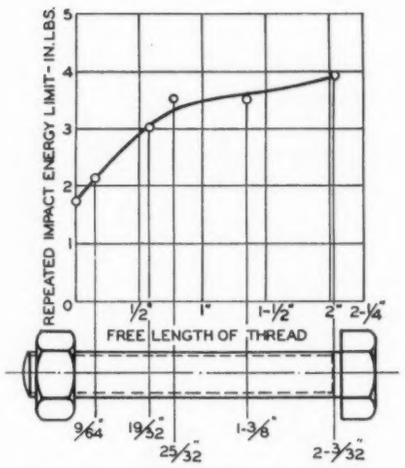
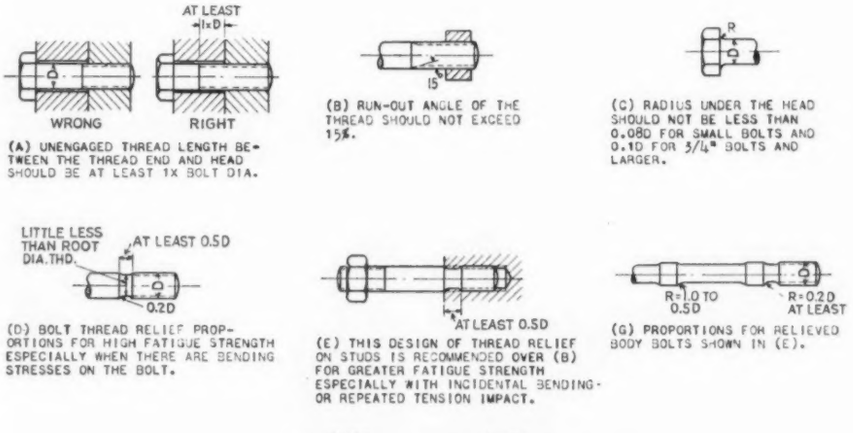
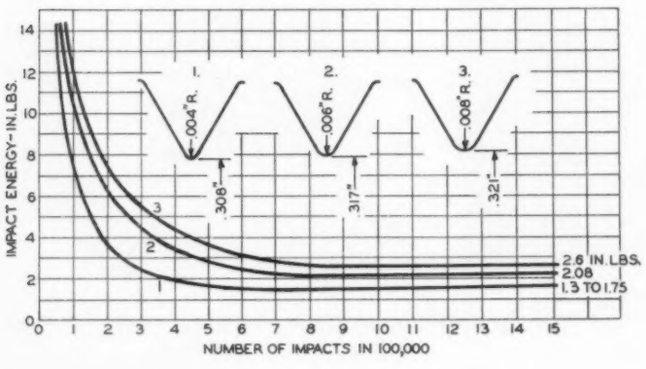


FIG. 11—Effect of the length of free threads under the nut on the repeated impact fatigue strength of bolts. By Staedel. Steel C used in Table II.



ABOVE

FIG. 14—Recommendations for bolt design when high fatigue strength is required. By Staedel.



AT LEFT

FIG. 13—Effect of root radius of thread on repeated impact fatigue limit of bolts. By Staedel. Steel C used in Table II.

locomotive driver axles 13 in. in diameter, which were developing fatigue cracks in the wheel fit, were replaced with axles having an annular groove ½ in. deep around the axle at the inside wheel hub face similar to Fig. 3d.

In some press-fitted applications the pressed-on members are periodically removed from the axle for detection of fatigue cracks in the fitted portion. Railroad and airplane applications represent such examples, and in these cases the allowable stress at which the axle will not crack, as given in Table I, is of much importance to the designer. In many other applications the breaking-off strength of the axle is of greater importance. It is desirable, however, to obtain as large allowable fatigue strength as possible for both cracking and breaking off values.

A number of applications are found in practice where hollow cylinders are subjected to diametrical loading, such as shown in Fig. 4. The problem is to determine what maximum stresses are developed at the boundary of the hole for various proportions of a/b. Photoelastic studies were made of various Bakelite models with various a/b ratios and a typical fringe photograph is shown in Fig. 5. Summary analysis of a number of such fringe photographs is expressed in Fig. 6 which enables the designer to calculate the critical stresses and predict failure.

It has been found from fatigue tests that single grooved specimens, like Fig. 2b, exhibit a lower fatigue strength than when a multiple number of grooves or threads are used similar to that shown in Fig. 2c. Weigand[4] found 56 per cent greater bending fatigue strength of multiple over single threads, and some improvements may be expected from the lower stress concentration shown in the photoelastic study of Fig. 2c over Fig 2b. Moore[5] also obtained increased strength from a series of screw threads over a single thread. Other cases of where the stress concentration due to one notch is relieved by the addition of a new notch are shown in Fig. 7.[6] It will be observed that some of the examples shown in Fig. 7 are analogous to the grooved axle in Fig. 3d where increased fatigue strength was also obtained.

Sometimes a more gradual transition in shape may be made using two fillets or undercut fillets to reduce the stress concentration over that obtained with a single fillet. An undercut fillet often permits the use of a larger radius than the plain fillet although too little use of it is found in engineering design. Fig. 8 illustrates some fillet studies on roll necks as a means of studying what improvement in fatigue strength may be obtained at the journal fillet.

A frequent place for fatigue fracture of bolts is in the region of the first few threads of the nut. Static tests of bolts give little information on bolt failures resulting from repeated loading. Photoelastic and repeated loading tests have been made on bolts in an effort to improve their fatigue and re-

TABLE I

COMPARISON OF FATIGUE LIMIT FOR SEVERAL AXLE DESIGNS

AXLE DESIGN (a)	D INCHES	L/D	PHOTOELASTIC PHOTOGRAPH FIG. NO.	ENDURANCE LIMIT STRESS (b) FOR AXLE WHEEL SEAT AT WHICH AXLE WILL NOT			
				CRACK		BREAK OFF	
				P.S.I.	%	P.S.I.	%
WITHOUT PRESS FIT	2	-	-	34,400	100	34,400	100
WHEEL AXLE	2	0.69	3-b	8,000	23	14,000	41
	7	1.00	3-b	9,000	—	11,000	—
	2 Rolled (c)	0.69	3-b	~8,000	~23	35,000	102
D/d=1.08	7	1.00	3-c	12,000	—	14,000	—
5/32" R x 5/64" DEEP	2 (d)	0.69	3-d	19,000	55	>22,000	>64

(a) Axle steel in all cases was S.A.E. 1045 but 2d axles were normalized and tempered while the "a" axles were in the "as-forged" condition.
(b) Referred to here as nominally calculated bending stress obtained by dividing bending moment in axle at wheel fit by section modulus at same place.
(c) Axle wheel seat cold rolled before mounting wheel.
(d) Unless groove is rolled, axle will break through groove at 17,000 p.s.i. and above.

TABLE II

EFFECT OF BODY DIAMETER OF BOLT AND BOLT STEEL ON THE REPEATED IMPACT FATIGUE STRENGTH OF BOLTS

(BY STAEDEL)

BOLT DESIGN	BOLT BODY Dia. - In.	BOLT BODY Area - Sq.In.	BOLT BODY AREA IN % OF AREA AT ROOT OF THREAD	REPEATED IMPACT FATIGUE LIMIT STEEL A In. lbs.	STEEL A %	STEEL B In. lbs.	STEEL B %	STEEL C In. lbs.	STEEL C %
1	15/32"	0.175	230	1.73	100	1.73	100		
2	25/64"	0.122	160	2.60	150	2.26	130	~2.17	100
3	5/16"	0.076	100	4.34	250	2.78	160	~3.47	160
4	9/32"	0.060	78	5.21	300	2.95	170	5.21	240
5	35/64"	0.044	57	6.51	375	3.65	210		

	%C	%Mn	%P	%S	%Si	Ult.(psi)	Yield(psi)	%Elong.	%Red. Area	Bolt Ult.*
Steel A	0.15	0.65	0.095	0.186	0.04	78200		12.8	56.0	93900
Steel B	0.25	0.75	0.019	0.024	0.25	96400		12.8	54.0	118900
Steel C	0.33	0.70	0.039	0.027	0.18	85300-99600	>68300	16-10		118000

*Static tensile strength of actual bolt, design 2, having 5/32" length of free threads under nut.

peated impact strength. Some very interesting conclusions of practical value were obtained by several investigators.

Weigand[4] investigated ¾ in. bolt and nut assemblies using various kinds of nuts, and made tests under the application of alternating tension and compressive stresses. Some of the results of these tests are summarized in Fig. 9. Improvement in fatigue strength of the threaded portion of the bolt which fits into the nut was obtained in many cases by relief of the load concentration on the first few threads and distributing the load over the upper threads of the nut. This was accomplished by several different methods: (a) annular relief groove in the nut, (b) 10-deg. thread relief in nut, and (c) cast iron nut or use of hemp in screw threads.

Photoelastic study of the usual nut and bolt assembly is shown in Fig. 10a, and this design is similar to design M in Fig. 9. The fringe photograph of a relieved thread design of nut similar to R7, Fig. 9, is shown in Fig. 10b. Here the deflection of the first few threads of the nut causes the load to be transferred to the upper threads. This is indicated by the larger number of fringes appearing in the upper threads than in the lower ones.

The effect of tolerances and number of contacting surfaces between the nut and bolt and the fact that yielding often occurs in the first few threads near the bottom of the nut prevent satisfactory numerical values of stress concentration being determined by photoelasticity. Such numerical values are given, however, by Moore.[7]

Bolts are frequently subjected to repeated impact in the direction of their length and Staedel[8] investigated this condition for various bolt designs and materials with the results shown in Table II. While engineers have realized for some time that a bolt with reduced body diameter will withstand greater impact energy than if the body is not reduced, the quantitative values given in Table II are of much interest to the designer and user of bolts.

The free length of the thread under the nut also influences the impact fatigue as well as the alternate tension and compressive fatigue strength of the bolt, as shown in Figs. 11 and 12. The magnitude of the radius at the bottom of the thread also influences the ability of the bolt to withstand impact as illustrated in Fig. 13.

Staedel summarized his findings on bolts in a manner suitable for the use of the designer and some of his designs are given in Fig. 14. The bolt conditions shown incorporate the results of what has already been previously indicated from photoelastic and fatigue tests as contributing to maximum bolt strength.

[4] H. Weigand, "Uber die Dauerfestigkeit von Schraubenwerkstoffen und Schraubenverbindungen," Bauer & Schaurte A.G., Neuss, Germany, 1934. Using bolt steel with ultimate strength of 61,000 lb. per sq. in. and yield strength of 41,300 lb. per sq. in.

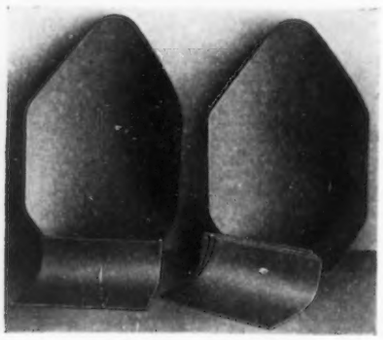
[5] R. R. Moore, "Effect of Grooves, Threads, and Corrosion upon the Fatigue of Metals," Proc. Am. Soc. for Testing Materials, Vol. 26, Part II, p. 255, 1926.

[6] A. Thum and E. Bruder, "Danger of Fatigue Failure in Grooves of Shafts and Axles and its Diminution" (Dauer bruchgefahr und Hohlkehlen von Wellen und Achsen und ihre Verminderung). Deutsche Kraftfahrforschung, No. 11, 1938.

[7] H. F. Moore, "The Strength of Screw Threads under Repeated Tension," Bulletin No. 264. Engineering Experiment Station, Vol. XXXI, March 13, 1934.

[8] W. Staedel, "Fatigue Strength of Screws" (Dauerfestigkeit von Schrauben), Mitteilungen der Materialprufungsanstalt an der Technischen Hochschule Darmstadt, Vol. 4, Berlin, 1933.

ARMOR PLATE FOR AIRPLANE PILOTS



CURVED armor plate for airplane pilots, specially heat treated to secure maximum resistance to penetration.

o o o

ONE of the latest developments in the application of steel to wartime purposes is the use of light armor plate for the protection of airplane pilots from machine gun and anti-aircraft fire, according to the Jessop Steel Co., Washington, Pa., which reports that it has just completed shipment on a large number of sets of armor plate to be installed in the cockpits of combat planes. Two sets of these armor plates are shown in the accompanying illustration. These pieces are so placed as to afford protection to fire from below and from the rear.

Both pieces are curved to provide greatest possible comfort to the pilot; furthermore, bullets will also ricochet off the curved plate more readily than off a flat plate.

The armor plate for this order was specially heat-treated to procure maximum ballistic resistance to penetration. As a result, it was possible to use a comparatively thin gage steel and thus reduce weight of the pieces to a minimum, while fully protecting the pilot.

The Jessop Steel Co. also makes armor plate for use in police cars, payroll trucks, tanks, shields for banks and jails, and in other places where bullet-proof steel is needed. Sheets and plates can be furnished which will withstand .38 and .45 calibre pistol and sub-machine gun bullets, as well as .30 calibre Springfield Rifle fire.

PRODUCING STEEL TO MEET PHYSICAL TEST REQUIREMENTS

By C. H. HERTY, Jr.
Research Engineer, Bethlehem Steel Co., Bethlehem, Pa.

Herein, four general grades of steel have been used to illustrate the hazards and the costs involved in meeting physical and chemical test requirements. In many other grades similar types of problems exist.

It will be noted that many items which involve cost to the producer, and in the end to the consumer, are due either to incompatible requirements, or to a demand that the producer furnish material in a narrower range of composition or properties than can satisfactorily be met without rejecting a large portion of the steel. If the consumer would modify his more or less inflexible manufacturing program, a great deal of the increased cost of steel production would not be necessary. The actual expense of such changes in processing by the consumer would, in most cases, be far less than that involved in the producer's losses. There are good grounds for believing that the ultimate costs involved would be lower if both producer and consumer were to share in the responsibilities for obtaining the maximum yield of usable steel at the minimum cost.

The discussion herein of this very important problem is an abstract of a more complete paper presented by Mr. Herty at the general meeting of the American Iron and Steel Institute, New York, May 23.

IN listing the hazards of the steel-making process, the first thought naturally turns to the making of a given ladle analysis. Even with the most up-to-date technical control methods, a chemical analysis cannot be predicted with certainty when the heat goes into the ladle. The action of the slag on the oxidizable alloys added and the variations in tapping conditions cause differences in analysis from heat to heat of a given grade. On certain grades of steel where incidental alloys are required to be less than a maximum, there is always the chance that through normal variation of the scrap charged, a heat charged for a definite purpose may have to be diverted because the incidental alloy content is too high.

The first hazard then is in analysis outside of the specified range, either through unpredictable non-uniformities of the charge, or through the action of the furnace slag in changing the efficiency of the various additions, and in causing a spread in one or more of the chemical elements of the steel in the ladle from heat to heat. Even though scientific controls have been of much help to the melter, the steel-making process is far from being an exact science. The point worthy of most note is that chemical composition control should have reached its present state of refinement in spite of the difficulties involved in handling reactions, both physical and chemical, at the high temperatures involved in the steel-making process.

It is a well known fact that chemical composition and physical properties are definitely related under similar conditions and that in order to meet physical property specifications, it is necessary to produce a steel with a limited range of composition. In order to illustrate how greatly the steel maker's problems are magnified by restricted ranges of chemical analysis, the table below has been prepared to show the expected percentage of off-grade heats which will occur in a modern open hearth plant well equipped with the latest instruments and facilities for assistance in the control of the analysis of the heat. The heats involved cover a wide range of carbon contents in a shop which makes a great variety of carbon steels with no extensive runs on any one grade. This table, which is taken from a statistical

study made by a large producer of carbon and alloy steels, shows the probable off-grades for carbon alone.

Grade Mean of Carbon	Percentage of Off-Grades Expected Permissible Range in Ladle Carbon, Per Cent			
	0.10	0.08	0.05	0.03
0.10	0.02	0.25	4.5	17.0
0.25	0.35	1.7	11.2	27.5
0.55	1.7	5.0	19.0	37.0
0.70	4.5	9.5	26.5	45.0
0.90	11.5	20.0	39.0	55.0

When check analysis is specified, that requirement is equivalent to restricting the above ladle carbon ranges by two to four points, depending upon the mean of the carbon range, and this tremendously increases the possibility of off-grades in the extremely narrow ranges which many consumers are now beginning to use. Similar restrictions in the range of other elements to ranges closer than those considered standard within the industry will further influence the responsibility placed upon the steel manufacturer. In considering the more common grades of steel, a great percentage of which are in the lower carbon ranges, off-grade heats are not as great a problem as in the higher carbon ranges, because diversions are more readily made. The greater problem is on those grades which carry additional features, such as alloy components, grain size, hardenability limitations, etc. On these grades diversions are often impossible and whole heats may be scrapped or held in stock for long periods of time.

Steel is teemed into ingot molds of various sizes and dimensions depending upon the products to be made. When the liquid steel solidifies in the mold there is a preferential crystallization which results in segregation of carbon, phosphorus, sulphur, and to a lesser extent of other elements. The degree of segregation depends upon the type of steel being made. In rimmed steel, as has been many times reported in the literature, the segregation of the three elements noted above, and of oxygen is great. In killed steels it is minimized, but there is nevertheless a considerable segregation, particularly in the larger ingots required for sufficient mechanical hot work. The steel maker is constantly attempting to modify conditions which promote segregation, so that this natural, although undesirable, feature of the ingot may be alleviated.

The results of segregation in the ingot, combined with a variable ladle analysis, are immediately reflected in variations in physical properties in steel from different parts of an ingot, and if a restricted physical property range is desired, it may be necessary that only a portion of the ingots from selected heats will be applicable. For example, in making certain grades of rimmed steel where restricted carbon range is desired by the consumer, it may be necessary to use the bottom two-thirds or even less of the product of the ingot on one heat and the top two-thirds or less of the product on another heat. Such a situation obviously involves considerable expense in the separation, selection and testing of the steel before it leaves the producer's plant, and also involves heavy diversion from the product for which the heat is intended. This latter may become extremely expensive if there are no suitable grades into which to roll the diverted material, and frequently results in scrapping of these diverted portions.

In killed steels the segregation is not as great as in rimmed steels, but it is nevertheless such that careful selection of parts of heats is necessary where close chemical or physical requirements are placed. Some large tonnage steel users have adjacent or overlapping chemical specifications. In this case little steel is actually rejected on account of segregation, but careful judgment and a considerable amount of check analysis are necessary to make the proper application of the various heats, or portions of heats, intended for such grades.

In case definite physical properties are not specified, but the steel is simply ordered to fill a certain job, the hazards of manufacture may be greatly increased. In many requirements of this type, it is absolutely necessary that heats be carefully picked, that certain portions of the ingot be diverted, and that a large amount of testing be done before the product is shipped.

Plate Steel

With the variations in size and thickness of the product and, therefore, with a wide variety of hot reductions and finishing temperatures, plate steel is an excellent example of the difficulties which confront the mill in meeting physical property requirements. Many plate grades, particularly the higher qualities, often specify two or more interlocking tests, coupled with requirements such as the ability to withstand various types of bending, forming and punching. This grade of steel must also respond properly to many modes of welding technique and the successful application involving these essential features is a most complex problem.

Physical tests on plates hinge mostly around tension and bend tests where a spread of 10,000 lb. per sq. in. in the tensile is standard practice. Plates from 7/32 in. in thickness up to as thick as 4 in., and varying in width from 19 in. to possibly 190 in., must meet this requirement for tensile, likewise the individual weight of plates within these ranges may vary from a few hundred pounds to as much as 20 tons. This wide spread must be considered in setting up ingot molds at the open hearth, so that certain weights necessary must be confined to the proper dimensions to insure correct heating, handling and in order that quality might not suffer.

Such factors as percentage of reduction from ingot to finished plate, finishing temperature of the plate, the latter having a most important bearing on the tensile strength and ductility, amount of cross-rolling as affecting the transverse properties of the steel, must all be considered by the provider in setting up the chemical analysis for each particular grade of steel.

For example, in meeting a tensile requirement of 55,000 to 65,000 lb. per sq. in., the following carbon ranges must be furnished to give this tensile range on different sized plates.

Plate Thickness, In.	Carbon Range Finished, Per Cent
¼	0.16 to 0.18
1	0.22 to 0.25
2	0.25 to 0.28

Light gage plates require a greater number of passes through the rolls, all of which reflects itself in a lowering of the temperature of the finished material. This is also reflected in the grain size of the final product, which, in turn, directly affects the tensile strength and ductility.

Cross-rolling in the case of sheared plates must be sufficient to insure good transverse properties, as measured by the bend test and other properties involved in fabrication. This operation must be considered in setting up the chemical analysis, since the final temperature after the last finishing pass is lowered where much cross-rolling is anticipated.

When it is considered that open hearth heats range from 100 to 200 tons in weight, it is easy to realize that one particular heat may be entirely suitable for a given product and entirely unsuitable for another, simply because the sections of the two products are different. This naturally causes considerable stocking of material to meet different size requirements, or rolling mill conditions must be adjusted as far as possible as to finishing temperature. Stack annealing or ac-

celerated cooling must be resorted to. Each one of these special operations results in increased costs.

The trend toward higher boiler pressures and the lightening up of equipment has been responsible for the introduction of many types of alloy steel plates, as well as various combinations of carbon and manganese as related to plain carbon grades, all of which have a marked influence on the "as-rolled" product with respect to physical tests and difficulties involved in meeting them.

Many of these steels are sensitive to temperature variations as reflected in the physical properties; an additional difficulty to be considered where very often it is necessary to pile the material to retard the rate of cooling.

With the development of electric arc welding, and the trend toward higher current densities and increased welding speeds, the plate producer's job has become increasingly difficult.

In many cases the mill must meet both the requirements for arc welding and for cold flanging on the same grade. In order to meet these two requirements a different grade of steel must be made than if only one requirement was specified, and the mill must also aim to apply heats on the low side of the tensile specifications and to obtain the maximum possible cross-rolling in order to meet the cold flanging requirements. In many instances this combination of requirements becomes so restrictive as to reduce the yield of applicable steel in the ingot to startlingly small proportions. If, as often happens, the non-applicable portion of the product cannot be directly diverted, it must either be scrapped or further costs must be imposed to make usable perfectly good steel.

An excellent example of a physical and a chemical specification which works real hardship on the manufacturer is found in the high tensile plate steel specification as follows: 0.45 to 0.55 C, 1.20 to 1.50 Mn, Brinell hardness 225 minimum as rolled. In order to meet the Brinell requirements, it is necessary to grade the heats for the open hearth as 0.50 to 0.55 C, *aim* 0.54; manganese 1.35 to 1.50, *aim* 1.40 to 1.50. It is quite obvious that with such a carbon and manganese requirement and aim, a high percentage of heats will be off-grade because, although they may meet the chemical specification, they will not meet the hardness specification.

For beams, angles, channels, and other shapes, the same hazards are encountered and precautions as those indicated above for plate steels must be used.

Bars

Bars are furnished to meet physical properties in the as-rolled condition and are also sold to meet definite properties in the heat treated or forged and heat treated states. With full ranges of chemical limits, tensile or hardness values cannot be guaranteed in steel in the as-rolled condition. Some carbon bars are furnished to physical requirements, in which case the carbon is not limited; other specifications restrict the phosphorus and sulphur only. In the annealed condition bars may be furnished to maximum specified hardness or structure desired. Minimum physical values can be guaranteed on quenched and drawn parts for hardness of tensile properties. A range of tensile or hardness values for quenched and tempered steel may be desired, in which case a reasonable range of Brinell hardness or its equivalent must be permitted at the location of the test.

In many grades of bars as-rolled physical requirements are specified which cause the manufacturer to apply steel in a much more limited composition range than is customarily given in the ordinary chemical specification. For example, a physical test requirement is given as 75,000 lb. per sq. in. minimum, yield point of one-half tensile strength and elongation in 2 in. of 18 per cent. Carbon is not specified and the manganese range is 0.60 to 0.90. In order to meet the elongation in the section ordered, the mill must grade the heat in three point carbon ranges for various sizes of bars in the range 0.33 to 0.38 C, and in addition must control the finishing temperature in the rolling mills with the greatest care.

In meeting hardening factors on forged and heat treated steels, the range of analysis supplied must often be far narrower than usually specified. In a specification where a small range of Rockwell "C" hardness is specified, it is absolutely necessary to limit the carbon to a 0.04 per cent range and the manganese to a 0.08 per cent range. On this basis many whole heats are diverted. The hazard and extra costs involved are obvious.

Many examples can be cited where two physical properties, particularly tensile strength and hardness, are specified. The specified ranges are often incompatible in that if the upper portion of the tensile range is met, the hardness will be above that specified. The mill must therefore work to a close range of chemical composition, in order to meet both specifications. This, of course, means an extra hazard in off-grade heats. For a given product there is a reasonably definite relationship between hardness and tensile strength, and it would seem that these two properties could be better correlated in specifications, thus reducing the hazards and extra costs involved in meeting these two requirements.

As in plate steel, variations in bar size require variations in carbon content to keep within tensile specifications. The amount of steel diverted or actually scrapped from this cause is high and in the end, of course, simply adds to the ultimate cost of the steel.

In addition to physical properties, the "as-rolled" grain size or the austenitic grain size is often specified. The former calls for special rolling techniques and the latter for special steel-making practices.

Many persons still confuse the austenitic grain structure with that of as-rolled grain structure, and demands are not infrequently made for grain size control which is neither practicable from a manufacturing standpoint nor needed from the standpoint of desired properties. The real control of austenitic grain size involves hazard and expense. If it is specified in the middle of the range, the steel maker has no assurance of meeting the requirement no matter how carefully the steel is made.

The requirement of hardenability involves even greater hazard, for here both grain size and composition requirements are to be met in addition to any physical tests to which the product may be put.

Rods and Wire

In addition, it is necessary that steel be made to give uniform reproducibility of heat treatment from heat to heat and this, of course, requires the utmost care in selection of material. Furthermore, inasmuch as various consumers utilize different methods of heat treatment to obtain the same general ends, it is often true that material made for a certain product will be unsuited for a similar product heat treated under different conditions, simply because the two types of heat treatment should require two different kinds of steel. This means that there are many cases where two grades of steel must be made where fundamentally only one should be required, thus adding to the manufacturing costs of the procedure.

Rods and wire cover a tremendously broad field of application in American

industry. From extraordinarily high tensile cold drawn wires to the common grades of soft wire, and from the products requiring the utmost quality for cold heading to those used as welding rod, all types of service and varied requirements are met. Three of the major hazards involved in manufacturing rod and wire are: (1) the extremely restricted chemical analysis range required for wire which is to be used for drawing into high tensile parts, and this embraces primarily the high carbon wire field; (2) the narrow limits of composition required for welding wire and wire for fine wire drawing; (3) the extremely severe requirements on surface for those wire or rod products which are to be subjected to "cold heading."

When high carbon wire is drawn to obtain high tensile properties, differences in composition are greatly magnified, and in the high carbon ranges the hazards involved in meeting these high tensile requirements are well illustrated by the percentage of off-grade heats expected as shown in the table, where 25 to 55 per cent of off-grade heats may be expected when working to narrow carbon limits on high carbon wire. As stated previously, the diversion of heats in these high carbon ranges is an extremely serious problem as there are few products to which off-heats can be diverted. This is a source of very high cost to the producer.

In making welding wire from rimmed steel, a very narrow carbon range is usually specified and the meeting of such a specification results in extraordinarily high diversions of parts of heats or parts of ingots in order that the desired carbon range may be furnished. In the manufacture of rimming steel, the qualities desired from this grade are made expensive by the marked segregation which is found in this type of ingot, and it is not uncommon to find that in a month's average performance not more than 50 per cent of the normal product of the ingot can be applied on the grade for which the heat was made. The diversions on these grades, in addition to the numerous chemical analyses which must be performed on each heat in order to insure the shipment of steel within composition limits, is a very costly item to the steel producer.

In meeting requirements for fine drawn wire, it is necessary that extra precautions be taken in the manufacture of the steel to insure that all the chemical elements involved be in the proper proportions to obtain the desired ductility of the product in drawing. In these grades small changes in composition profoundly affect the hardness of the cold drawn product, and normal variations in open hearth operations also have a decided effect, and the diversion of heats and of a fairly large percentage of the upper portion of the product of the ingot is common. Here again are added items of expense which the manufacturer must begin to take into serious consideration.

In the broad group of wire products generally classed under Manufacturers' Wire, cold heading wires and rods furnish an interesting example. In recent years so much progress has been made in cold heading and cold forging that many items which were formerly hot forged or machined from bars are now cold forged. This has resulted in important economies in the manufacturing operations involved in the utilization of steel and has provided substantial improvement in the products for the ultimate consumers. To make such performance possible, however, has become an important problem to the steel manufacturer; a few examples will illustrate just what cold heading quality has come to mean to the steel manufacturer and to the users of steel.

In the case of wire used for the manufacture of wood screws and machine screws, the development of solid die heading processes has made it possible to dispense to some extent with the shaving of the heads to provide proper contour and finish. However, unless the surface of the wire is *perfect* and absolutely free from seams of even the slightest depth, the surface of the heads of the resultant product which has been headed to finish, is very likely to be less satisfactory than when the heads of the screws are shaved. Even though the character of the defects may not be of enough consequence to interfere with the utility of the product, the consideration of finished appearance becomes a cause for trouble, and in order to satisfy the trade it has become necessary to tremendously increase rod mill and wire mill costs. The same situation applies to practically all cold headed products. Thus, frequently, what might be looked upon as an improvement in one detail of a manufacturing process might not be justified economically when the total cost of the finished product is considered after the proper distribution and recognition of all contributing factors.

Cold heading is now no longer confined to soft steels. It is not unusual to cold head and cold forge steels even harder than 0.40 C, and such steels as SAE-1335 and certain other alloy steels. In order to accomplish this cold forging operation properly, a special preparatory heat treatment must be included in the wire mill practice. This is called spheroidizing annealing, and is much more expensive than plain annealing; moreover, on account of the prolonged cycles and temperatures employed, it is difficult to obtain the desired steel structure without danger of surface decarburization. This has forced into use more expensive equipment, has led to higher annealing costs, and has increased the hazards involved in making a proper delivery. Frequently also the finished product is required to meet very close physical test limits after a final heat treatment by the consumer, which imposes further limitations on the steel manufacturer in his endeavors to produce a material which will successfully meet all requirements which are being demanded.

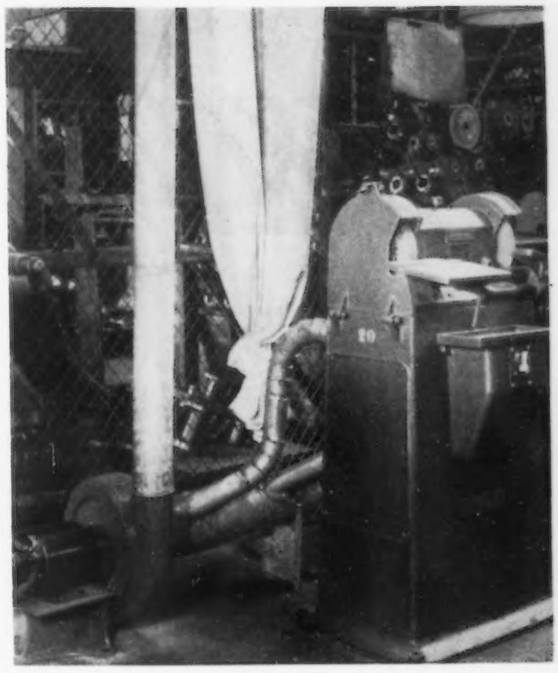
Sheet and Strip

The lighter gages of flat rolled products which are classified as hot-rolled and cold-rolled sheets and strip, and the still lighter gages as tin mill black plate, are usually manufactured from low carbon steels which are those considered as having a carbon content of less than 0.25 per cent. Most of this steel is "rimmed" in order to obtain maximum ductility in the product. Those not familiar with the manufacture of sheets and tin plate are likely to regard variations in chemical compositions of these steels in the low carbon ranges as relatively unimportant in relation to the physical properties of the steel. Actually, small differences in carbon, manganese, phosphorus and sulphur, as a rule, are the difference between failure and success in the ultimate use for which these products are intended. In producing these light gage products in the rolling mill, a number of operations are necessary before the product is suitable for the manufacture of the intended part. The major operations consist of hot rolling, normalizing, pickling, cold reducing, box annealing, skin or temper rolling. All of these operations must be carefully controlled so that the cumulative effect of all, or group, of them will produce a product suitable in surface, section and physical properties to meet definite requirements.

The sheet and strip manufacturer produces these products to chemical specifications; to physical properties; to make a definite part (generally in-

(CONCLUDED ON PAGE 89)

DUST COLLECTOR FOR TOOL GRINDER



INEXPENSIVE shop-made dust collector for tool grinder.

THE dust kicked up by a new Carboloy tool grinder, in the Philadelphia plant of the Yale & Towne Mfg. Co., gave the surrounding area the appearance of a flour mill. As this was decidedly contrary to the clean shop policy of the maintenance department, H. C. Rose, plant engineer, decided to do something about it. In order to keep cost down, the blower outfit shown here was designed and built in the shop. The total cost for equipment and labor was $110.

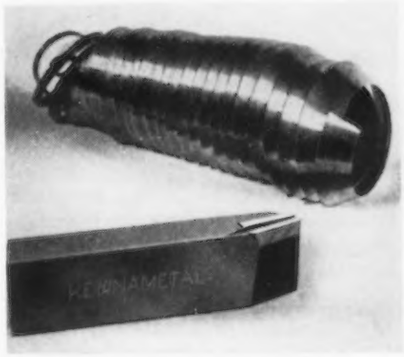
The working element consists of a small blower driven by a ½ hp. motor. The intake side of the blower is connected to a 6-in. diameter sheet metal receiving chamber, to which a pair of 2-in. feeder lines run from the hood of the grinder. The output side of the blower connects with a 4-in. sheet metal pipe which carries the dust vertically and deposits it into a long hanging canvas bag. The lower end of the bag can be opened, so that the accumulated dust can be removed into buckets. The blower motor is connected so as to automatically begin operating as soon as the grinder is started.

All dust deposit around the grinder is now a thing of the past.

CEMENTED CARBIDES FOR SHELLS

REMARKABLE strides in Great Britain in the use of cemented carbide tools for the machining of shell forgings and the hard steels used in the manufacture of war material are reported by A. H. Alexander, member of the firm of George H. Alexander Machinery Ltd., Birmingham, England, who is at present in the United States arranging for an increased supply of cemented tungsten titanium carbide ($WTiC_2$) for machining tough alloy steels.

Carbide tools are now being widely used by airplane manufacturers in England for machining stainless steels and nickel chrome molybdenum steel, reports Mr. Alexander. The problem of meeting the increased production demands due to the war is being met by using these new carbides, whereby the output of existing plant and labor facilities is increased as much as 100 per cent. Shops machining shell forgings are tooled up 100 per cent on carbide tools.



CONTINUOUS chip produced by cutting a 5½ in. diameter rough steel shell forging with a Kennametal tool on a Drummond lathe in a British munitions factory. Cut was made dry, depth of cut ¾ to ⅞ in., feed of 0.008 in. per rev., and with the work turning at 250 r.p.m. (360 ft. per min.).

While it is difficult to present any accurate percentage figures on the increased use of hard carbide tools, Mr. Alexander said that British plans for production of hard carbides on a very extensive scale have reached an advanced stage and that within a short period of time the use of carbide tools would reach amazing proportions. Even before the war, England had been cognizant of the advantages of hard carbide tools and perhaps their use was more general than in the United States.

George H. Alexander Machinery Ltd. has just completed plans for the erection of two additional plants in Great Britain for the fabrication of carbide tools and the firm is negotiating the formation of a Canadian subsidiary for manufacturing carbides.

PICKLING and POLISHING

THROUGHOUT the centuries metals have been used and the metal worker has been at grips with the problem of preparing the surface of the metals. During casting, hot working, annealing or heat-treating, the common metals develop a layer of oxide which the metal fabricator must remove. These layers of oxide may be thin films or heavy scale. They may represent mere discoloration of the surface or a roughened alligator hide appearance. The oxides may be adherent and uniform or they may be non-adherent in spots and so adherent in other spots as to take metal with them if forcibly removed. These scales or oxide films must be removed. During the process of manufacturing wrought metal products, it may be necessary to descale a number of times.

Descaling is accomplished in one or more of many methods. The most common method is that of acid pickling. A less common method is sand blasting or mud blasting. Another common method is grinding. In the vast majority of work, pickling has seemed to be the most economical process, and, therefore, the most commonly used.

After the scale or oxide film has been removed from metal, the real work of producing a desirable finished surface can be inaugurated. Again there are several methods which may be used. The methods can be roughly grouped under two main headings:

(A) Polishing without removal of metal from the surface, and

(B) Polishing with the removal of metal from the surface.

Cold rolling through polished rolls produces a fair degree of polish on clean metal without removing metal from the surface. This method of obtaining an apparent polish on the surface of metal is based on applying sufficient cold work to the surface to smooth out or close up all irregularities on the surface being rolled. To the naked eye and often even through the microscope, a polished surface produced by this method appears to be a uniform and homogeneous surface. Close examination under a high power microscope, however, often shows that the cold worked surface is simply honeycombed with a network of fine laps and fold from the closing in of the small surface cavities which were on the stock before being cold rolled. When the structure is so fine that the microscope does not show it readily, it may still be developed by the application of a light etch.

Many practical platers refer to the porous nature of the surface of wrought steel which they are asked to plate. Inherently, steel as such is non-porous, but if a steel is over-pickled and then cold rolled between polished rolls, an apparent polished surface can result which will be porous and will give the plater trouble. The true nature of a surface produced by rolling contact with a polished surface is dependent upon the previous history of the material being so polished. If the material has been badly over-pickled and pitted the final product will have a porous surface. If the material was not over-pickled and badly pitted, the finished product will have a fairly non-porous surface.

The other method of producing a polished surface on metals without removing material is that known as "burnishing." Burnishing has been practiced for centuries. Burnishing may be done by hand with hardened and polished steel burnishing tools, or may be done in burnishing barrels with hardened steel burnishing shot in the barrels. In either case, the effect is somewhat similar. By high pressure point and rubbing contact between the burnishing tool or material and the work, the surface of the work (softer than the burnishing tools or material) is caused to flow and to become smooth and present an apparent polished surface.

In this product, the same situation exists as in the case of polishes produced by cold rolling between polished rolls. If the original metal surface was over-pickled, deeply etched or pitted, the burnishing simply smears the surface sufficient to close these pits or pockets and the surface is inherently a porous surface. If the original material did not have these pits and pockets in it, then the final burnished surface is not inherently porous.

The material removal methods of producing finishes on metals are nominally referred to as cutting, polishing buffing or coloring operations. Starting with emery and proceeding to finer and finer grades of grit, the surface of the metal is finished by repeated removal of thin layers. The coarser and sharper the emery used, the more metal is removed. All of these operations up through those called polishing are cutting operations. The operations sometimes referred to as "buffing" and "coloring" are more truly burnishing operations. All of these operations are costly in both equipment, materials and labor.

Many of the problems which arise in connection with the polishing of metals have to do with the nature of the metal itself. The type of polishing wheels and polishing grit must be adapted to the metal being polished. Soft metals require a different combination than hard metals. The thermal conductivity of the metal being polished is of importance. Stainless steels are difficult to polish due to their poor thermal conductivity and the tendency to local overheating. Other problems in connection with the polishing of stainless steel have to do with the limitation which must be placed upon the type of polishing media that can be used which will not contaminate the surface of the stainless steel and cause it to rust. In the case of stainless steel, some passivating treatment must be applied to the surface after polishing even though

# of Metals

By SAM TOUR
Vice-President, Lucius Pitkin, Inc., New York

WITHIN recent months THE IRON AGE has in three articles presented all available data on strides made in electrochemical polishing of metals, a technique which has recently developed considerable commercial activity. The three articles dealt with processes sponsored by Allegheny Ludlum Steel Corp., Rustless Iron & Steel Corp., and Battelle Memorial Institute. So far as is known, the only other major process being actively investigated or merchandized is that in which Lucius Pitkin, Inc., has an interest. To round out the coverage of this subject, therefore, the story of Lucius Pitkin as regards electrochemical polishing of metals is told herein.—Ed.

the media before polishing has been carefully selected.

In view of the many problems in the metal industry in connection with descaling, pickling and polishing of metals, there should be and there is a great interest in any new method developed for any one or all of these operations. About four years ago, the author began to hear something about electropolishing. Electropolishing is a form of electropickling. Electropickling has been practiced in the metal industry for many years. To properly trace the history of electropolishing, it is necessary to begin with electropickling of approximately 25 years ago.

The following is in effect an annotated history of electropickling, still pickling and electropolishing for the past 25 years.

Pickling whether still pickling or electropickling should not be confused with washing, cleaning or electrocleaning in solutions containing various cleaning reagents. In the ordinary cleaning process, the desire is to remove extraneous or foreign materials from the surface of the metal whereas in the pickling processes some metal or metallic compound firmly adherent to the surface of the metal is removed.

1915 to 1920:

Fritz Blau of Germany, United States patent No. 1,157,288 of Oct. 19, 1915, describes the manufacture of fine refractory metal wires by chemical or electrolytic anodic treatment. After he had drawn tungsten wire to as small a diameter as was thought possible by the ordinary drawing methods, he further reduced this diameter by making it the anode in an electrolytic bath.

M. DeKay Thompson and F. W. Dodson, *Metallurgical & Chemical Engineering*, Dec. 15, 1917, discussed the electrolytic pickling of steel. Using lead anodes and with the steel as the cathode, they descaled in 1.19 specific gravity sulphuric acid solution. They reported obtaining silvery white and very clean surfaces. For silicon iron they used 35 per cent sulphuric acid and 2 per cent hydrofluoric acid.

Quintin Marino of England, United States patent No. 1,324,317 of Dec. 9, 1919, describes an electrolytic method of cleaning iron and steel. With the steel as the cathode, an electrolyte made up of soluble sulphates and fluorides, at temperatures of 150 deg. to 180 deg. F., he employs current densities of 10 to 30 amp. per sq. ft., although he reports going to as high as 100 amp. per sq. ft. The principal object of this process was the removal of scale or rust from the surface of the steel.

1920 to 1925:

John Coulson of Pennsylvania, United States patent No. 1,374,552 of April 12, 1921, describes an electrolytic process for steel. The purpose of his process was the removal of scale from such items as heat-treated steel springs by acid pickling without the development of brittleness. Using sulphuric acid electrolyte with a specific gravity of 1.20, Coulson made the steel one electrode and used lead as the other electrode. The steel is made cathode first until the scale is almost all removed and then the current is reversed so that the steel is made the anode with a current density of about 60 amp. per sq. ft. By this means, Coulson avoided the development of hydrogen embrittlement due to the ordinary pickling processes.

G. E. Wertheimer of New York, United States patent No. 1,376,365, of April 26, 1921, describes a process of preparing stencil plates, die plates and the like by electrolytic etching or pickling. Lead foil is used as a stop-off and the steel is etched anodically in a solution containing 8 per cent of sulphuric acid, 2 per cent of nitric acid, 20 per cent of ammonium chloride, and small portions of acetic acid, copper nitrate and iodine.

Charles P. Madsen of New York, United States patent No. 1,562,710 of Nov. 24, 1925, describes a method of treating metallic objects and resulting products to promote adherence of electroplate. By his process, steel was treated anodically in a bath containing from 86 per cent to 92 per cent of sulphuric acid, at a temperature of about 130 deg. F., with a current density of about 100 amp. per sq. ft. at the start and decreasing to around 17 amp. per sq. ft. in 1 to 3 min. Voltages of approximately 42 volts were used. Mr. Madsen reported that the surface of the steel as treated by his process had an entirely different appearance to the eye from any other steel treated or untreated and especially from the same steel after pickling, being much whiter and more pearly. *This was the first apparent notice of the possibility of electropolishing.*

Arthur Z. Pedersen of New Jersey, United States patent No. 1,564,710 of Dec. 8, 1925, describes a method of preparing steel surfaces to be electroplated. His process is very similar to that of Madsen, just described, and consists of anodic pickling in 75 per

cent to 96 per cent sulphuric acid at 20 volts and current density of about 30 amp. per sq. ft. He reports the treated surface having been found to be of a clean gray metallic luster, which is readily electroplated.

1926 to 1930:

In April, 1927, C. H. Proctor, in answer to problem No. 3,629, in writing in the *Metal Industry*, Vol. 25, No. 4, page 164, describes an electro-strip for all commercial metals for the removing of nickel plate. For this strip, a solution is used which consists of 1 gal. of 66 deg. sulphuric acid, one pint of water and 1 oz. of glycerine. Cathodes of sheet lead or copper are used entirely surrounding the article to be electro-stripped. Voltages of 5 to 6 volts and amperages of 5 to 10 amp. per sq. ft. are used. Mr. Proctor reports that if care is used this process results in all metals having a smooth surface when the deposit is removed.

In 1928, P. V. Blackburn, writing in the International Nickel Co.'s magazine *Inco*, Vol. VIII, No. 1, on "The Theory and Practice of Pickling" gave no attention to electrolytic pickling for any work. He recommended for iron and steel the use of 2 to 15 per cent sulphuric acid at temperatures of 140 deg to 180 deg. F.

Robert M. Burns of New York and Clarence W. Warner of New Jersey, in United States patent No. 1,658,222 of Feb. 7, 1928, describe an electro-cleaning method for the preparation of surfaces for electroplating. The method described is anodic electro-cleaning where foreign matter attached to the surface is loosened by the evolution of gas and some of the metal is taken into solution. The electrolyte consists of 70 per cent to 100 per cent phosphoric acid by weight. The current density used is 100 amp. per sq. ft. and the recommended time of treatment is 3 min. Burns and Warner note that longer times will give brighter surfaces. Here again, there is a recognition of the possibilities of electropolishing.

It has been reported recently that the Allegheny Ludlum Steel Corp. is issuing licenses under this patent for the electropolishing of stainless steel.

In June, 1929, Mr. Ray L. Rolf, writing in Houghton's *Black and White*, Vol. 2, No. 1, on "Pickling as an Inspection Aid," discussed the various types of pickling and did not recognize electropickling. He described and recommended pickling iron and steel in a solution of 4 per cent to 5 per cent sulphuric acid.

Quintin Marino of France, British patent No. 305,036 of April 28, 1930, describes a method of removing iron oxide and rust from the surface of steel and iron without affecting the metal under treatment. In this process, sodium or potassium sulphate is added to phosphoric acid, obtained by treating pulverized phosphate of lime with dilute sulphuric acid (10 to 20 deg. Bé). This solution is used as the electrolyte. The surface to be treated is first made anodic and then made cathodic. The adhering rust thus loosened is removed by brushing.

Thomas E. Dunn of Connecticut, United States patent No. 1,775,671, of Sept. 16, 1930, describes an electrolytic method of cleaning metal. The Dunn method is a cathodic descaling method which simultaneously is an electrodeposition of a thin layer of tin or lead from a bath of sulphuric acid plus a lead or tin salt. Descaling is obtained by hydrogen evolution at the cathode. This patent is the basis of the well-known Bullard-Dunn process of descaling which is used quite extensively in industry. This process was further described in the October, 1930, issue of *Metal Cleaning and Finishing* under the title "New Electro-Chemical Method of Removing Scale and Oxides from Metals."

N. R. Laban in the *Journal of the Electrodepositors Society*, 1930, 5, 128, describes the development of clean satin finishes on steel by anodic treatment at 100 amp. per sq. ft. in 30 per cent sulphuric acid plus 3 oz. per gal. of potassium dichromate. This description should be borne in mind when one considers a patent by Fink and Kenney which will be described later in this paper.

1931 to 1935:

Frank V. Knauss, of Portsmouth, Ohio, United States patent No. 1,793,936 of Feb. 24, 1931, describes a method of fabricating metal coated articles which consist of an anodic treatment prior to nickel plating. The anodic treatment is carried out in a sulphuric acid bath of 85 per cent concentration at a temperature of 100 deg. F., and with a current density of about 20 amp. per sq. ft. This is a further development of the Madsen and Pedersen patent previously described.

In the March, 1931, edition of *Metal Cleaning and Finishing*, under the general title "Recent Developments" is a description of a new electrolytic pickling process developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J., and forming the subject of an application for United States patent. The patent finally issued to George B. Hogaboom of Connecticut, United States patent No. 1,865,470 of July 5, 1932, is entitled, "Electrolytic Bright Dip for Iron and Steel." In this process, Hogaboom descales the steel cathodically in 1 to 6 min. in a 2 per cent to 20 per cent sulphuric acid solution at a temperature of 70 deg. to 160 deg. F., and with a current density of 10 to 150 amp. per sq. ft. After descaling cathodically, the work is then bright dipped by being made the anode in a 25 per cent to 75 per cent sulphuric acid bath kept cooled to below 100 deg. F. and with a current density of 80 to 250 amp. per sq. ft. Hogaboom indicates his belief that the production of the bright surface on the steel is due to the anodic formation of persulphuric acid, the maintenance of which is favored by the high current density and the low temperature. This patent, also, should be kept in mind in considering the Fink and Kenny patent to be described later.

Francis Locke of Massachusetts, United States patent No. 1,824,608 of Sept. 22, 1931, describes a method of making polished annealed stainless steels. Bright rolled strip is annealed in a controlled atmosphere so that the high finish is oxidized only slightly and evenly, the strip is made the anode in an acid pickle bath and can then be buffed to a high polish. Locke describes the use of a 10 per cent sulphuric acid bath for this purpose.

In the October, 1931, issue of *Heat Treating and Forging* there was a reprint of a bulletin issued by the Mesta Machine Co. on "The Pickling of Metals, Up-to-date Practice in the Cleaning of Metal Surfaces." Here no mention is made of electropickling or electrocleaning. Various sulphuric acid concentrations of from 2 per cent to 15 per cent are recommended for various types of steel. Pickling is at 175 to 195 deg. F.

E. Jimeno and I. Grifoll in *Anales Society Espan. Fes. Quim*, 1932, 30, 794, described pickling in sulphuric acid in two steps. First the scale was immersed in dilute acid for some hours without current, and then was given an anodic treatment for from 2 to 3 min. in 70 to 75 per cent acid to remove stubborn scale.

Helmer Bengston of Indiana, United States patent No. 1,869,042, of July 26, 1932, described a process of coating aluminum in which the aluminum was made anode in 60 to 77 per cent of sulphuric acid plus one part of glycerine to 15 parts of the solution. He described that where a lustrous coating was desired on the aluminum, the alu-

minum should be buffed before treating. His solution should be compared to that described by Proctor in *Metal Industry* in 1927 and previously referred to in this paper. It will be noted that Bengston is producing an anodic coating on the aluminum and aluminum alloys and is not stripping electroplate from the alloys and is not attempting to produce a polished surface on them. In fact, this treatment does not electropolish the aluminum alloys.

The International Nickel Co. in their Bulletin TS-4 of March, 1933, on "Pickling Monel Metal, Nickel and Inconel" described the difficulties in treating these nickel-base alloys. No electrolytic methods are referred to in this bulletin. Mixtures of nitric acid and salts or straight nitric acid solution are used for removal of slight tarnish from monel metal while sulphuric acid and nitric acid mixes are used for the same purpose on nickel. Neither of these pickles is deemed applicable to Inconel. For removal of oxide or scale, a large number of formulae are recommended. This bulletin paints a very gloomy picture of the problem of removing oxide films, scale, etc., from the nickel-base alloys.

C. G. Fink and T. H. Wilbur, United States patent No. 1,927,115, of Sept. 19, 1933, describe the use of silicon-iron anodes in the Dunn process of cathodic descaling in a hot acid sulphate bath containing a trace of tin. They claim that a thin film of silica forms over the anode surface and largely prevents the oxidation of the ferrous salts on the anode.

C. G. Fink and F. J. Kenny of New York, United States patent No. 1,961,752 of June 5, 1934, describe a process of treating metal and alloy articles to improve the resistivity thereof to corosion and to the product thereof. They state, "The electrolytic treatment is preferably carried out in a bath having an oxidizing action on the metal or alloy being electrolytically treated, whereby at the same time that the surface, or portions thereof, are being dissolved, there is also an oxidizing or passivating of the surface effected." They also state, "While other electrolytic solutions may be used, best results have been obtained by the use of chromic acid solution. Examples of other electrolytic solutions are concentrated sulphuric acid solution, concentrated hydrochloric acid solution, concentrated nitric acid solution."

Fink and Kenny describe their process as a method of equipotentializing the surface of a metal in which differences in potential exist due to presence of particles of different metals, crystal structure, strains, etc. They describe their process as an anodic treatment to dissolve the points or areas of high electrolytic potential. They require that the bath be oxidizing and they recommend a 42.5 per cent chromic acid bath and a temperature of 40 deg. C., current density of 0.06 amp. per sq. cm. and a treatment time of 1 hr. They claim that articles treated by their process are twelve times as resistant to corrosion as those not treated.

FIG. 1 — Panel board carrying a number of stainless steel samples, which have been electro polished, electro - etched and descaled by the Blaut - Lang process. This panel board was displayed first in 1937 at the Metal Products Exhibit Hall in New York City.

To recapitulate, therefore, there is the following to offer with respect to anodic treatment of steel in acid solutions. Hogaboom in 25 to 75 per cent sulphuric acid, Locke in 10 per cent sulphuric acid, Burns in 70 to 100 per cent phosphoric acid, Pedersen in strong sulphuric acid, etc. It would seem quite obvious that what Fink and Kenny claim to have obtained in the way of equipotentializing the surface must have occurred, if it does occur at all, in the cases of Laban, Hogaboom, Locke, Burns, Pedersen and many others who treated metals anodically in acid electrolytes. Certainly Burns' phosphoric acid and Laban's sulphuric acid plus dichromate can be considered as oxidizing acids. Question might be raised as to hydrochloric acid having an oxidizing action, although Fink and Kenny refer to it as one of the acids that might be used.

R. R. Rogers in *Transactions of the Electrochemical Society*, 1934, 65, 357, described the descaling of high speed steels containing tungsten by anodic treatment in a bath containing sodium citrate and sodium hydroxide followed by a dip in hydrochloric acid. The alkali was used to leach out the tungsten and the citrate to help remove rust. It was claimed by Rogers that this method gave a cleaner surface than any acid pickle and that the method was quite rapid.

Laurance F. Van Mater of Lockport, New York, United States patent No. 1,978,151 of Oct. 23, 1934, describes a method of pickling metal such as rustless or stainless steel. He reports the difficulty with the ordinary methods of removing scale and oxide film from the chromium and chromium-nickel steels. By his process, Van Mater claims to convert the scale or oxide film from an insoluble to a soluble form by making the work the anode in an alkaline bath at a temperature of approximately 200 deg. F. Sodium hydroxide solutions containing from 8 per cent to as high as 50 per cent of sodium hydroxide are used. Treatments of from a few seconds to

two or more minutes are reported. The shorter times are used with high current densities and the longer times even up to 20 min. are used with low current densities. Following the anodic treatment in the alkaline solution, the transformed or modified scale or oxide is removed by pickling in 5 to 10 per cent nitric acid solution with or without the addition of a small percentage of hydrofluoric acid.

Leonard O. Larsen of Illinois, United States patent No. 1,984,534 of Dec. 18, 1934, described a method of cleaning nonferrous alloys. In this method, phosphoric acid is used as an agent to inhibit the formation of stains on work when exposed to air after dipping in acid. They report, "While either nitric or sulphuric acid may be used, it is preferable to use a mixture of the sulphuric and nitric acids. These acids may be mixed in various proportions and phosphoric added in accordance with the concentration of the bath. A suitable mixture has been found to consist of 50 per cent sulphuric acid, 36 per cent nitric acid, and 14 per cent phosphoric acid." Larsen claims that this mixture is particularly adaptable to cleaning nonferrous alloys containing copper, such as brass or bronze. No mention is made of the use of electric current and no mention is made of the possible application of this combination of acids to other than the copper-base alloys.

1935 to 1940:

During the latter part of 1935 and through the year 1936, P. A. Jacquet of France published a series of articles in connection with the electropolishing of copper. These appeared in *Comptes Rend.*, 1935, 201, 1473 and 1936, 202, 402; *Nature*, 1935, 135, 1076; *Bulletin of the Society of Chemistry*, 1936, 3, 705; and *Transactions of the Electrochemical Society*, 1936, 69. In these articles, Jacquet reported the obtaining of a mirror finish on copper by anodic treatment in phosphoric acid. Current densities were adjusted between that of passivity of the copper and of complete corrosion. He reported that copper compounds accumulate in the depressions on the surface of the copper and that passivity prevails in these depressions and projections remain active and are eaten away until the surface is smooth and mirror-like.

In the *Journal of the Electrodepositors' Society*, 1936, 11, 114, Mr. H. Sutton gives recommendations regarding the electropickling of steel. His recommendations are in effect the same as those of Laban in 1930 and call for anodic treatment of the steel in a 30 per cent sulphuric acid solution containing 3 oz. per gal. of potassium dichromate and a current density of 100 amp. per sq. ft. He reports that this treatment leaves the steel surfaces passive and with a clean satin surface or finish.

R. Muller and L. Harant in *Transactions Electrochemical Society*, 1936, 89, in connection with the electropickling of steel recommend a ferrous sulphate solution containing only 0.1 per cent of sulphuric acid.

Mr. N. D. Pullen in the *Journal of the Institute of Metals*, 1936, 59, reports on a process of anodic treatment of aluminum to produce high reflectivity. This is one of the first references to electropolishing of aluminum. Pullen reports the obtaining of high reflectivity on aluminum by anodic treatment in two baths. The first treatment is in a bath containing sodium carbonate and phosphate and the second treatment in a bath containing sodium sulphate.

During the years from 1935 to 1939 numerous articles appeared in the literature by P. Jacquet alone and jointly with others which described various methods of electropolishing of metals. The various references are as follows:

Comptes Rendus, vol. 201, p. 1473, 1935.

Comptes Rendus, vol. 202, p. 403, 1936.

Societe de Chimie Physique, vol. 33, p. 226, 1936.

Transactions of the Electrochemical Society, vol. 69, p. 629, 1936.

Bulletin de la Societe Chimique de France, vol. 3, p. 705, 1936.

Bulletin de la Societe Francaise des Electriciens, vol. 6, p. 547, 1936.

Comptes Rendus, vol. 205, p. 1232, 1937.

Comptes Rendus, vol. 208, p. 1012, 1939.

For steel of all kinds, tin and lead, Jacquet developed various mixes and concentrations of acetic anhydride and perchloric acid. Current densities from 4 to as high as 15 amp. per sq. dcm. are recommended and voltages as high as 100 volts. Most of the work of Jacquet has been checked recently and is summarized in a data sheet on page 57 of the January, 1940, issue of *Metal Progress*. There seems to be little question but that these mixtures of acetic anhydride and perchloric acid do develop a polish when used in accordance with the instructions given. It is unfortunate that the instructions given do not refer to the great hazard in the use of perchloric acid. Perchloric acid is a violent explosive and is dangerous for that reason. Acetic anhydride itself releases enormous quantities of fumes and is distasteful to work with. The use of mixes of acetic anhydride and perchloric acid might be permissible for small metallographic specimens being treated in the laboratory providing the operators are fully acquainted with the nature of the chemicals they are using and providing proper care is taken to prevent explosions. There would seem to be little possibility of any plant adaptation of such reagents for quantity treatment of metals.

James D. Kelvie of Ohio, United States patent No. 2,037,633 of April 14, 1936, describes a method of and apparatus for cleaning stainless steel. This invention has to do with the continuous treating of stainless steel strip which has an oxide coating on it due to annealing. The strip is made anode and cathode alternately during its pass along the tank. The alternate anodes and cathodes between which the strip passes are so spaced that the strip undergoes a straight chemical pickle before each electrolytic treatment. The temperature is kept below 100 deg. F., and the current reported as 600 to 1200 amp. at a voltage of 6 to 12 volts. (No statement of area treated is given with this current figure.) A bath of 15 per cent phosphoric acid is recommended with a speed of 6 ft. per min. and with five cathodes and five anodes. Mechanical washing and scrubbing are resorted to after electrolysis. The strip is then passed into a bath of 16 per cent nitric acid and 1 per cent hydrofluoric acid to complete the operation and the strip is again scrubbed and washed.

R. B. Mason and Martin Tosterud of Pennsylvania, United States patent No. 2,040,618 of May 12, 1936, describe a method of producing bright surfaces on aluminum. Starting with an aluminum article of high purity or with a high purity aluminum surface on it and buffing this surface to a specular reflecting condition, they then treated the surface anodically in a solution containing from 1 to 60 per cent of sulphuric acid plus 0.2 to 1.5 per cent of hydrofluoric acid. Voltages of 8 to 10 volts and current densities up to 100 amp. per sq. ft. and temperatures up to 60 deg. C. are reported. It is claimed that the original buffed specular reflecting surface has its reflection factor increased as the result of this treatment.

Ed. Note:—Next week the author concludes this article, with attention directed primarily toward the Blaut-Lang process of electropolishing. Past history and future possibilities are considered in detail.

Photo shows the Super-Diamond Pattern of "A.W." Rolled Steel Floor Plate. Provides safe tread from any angle, under any condition.

On busy floors . . . "A.W." Rolled Steel Floor Plate is a practical solution to floor maintenance problems on busy traffic aisles, stair treads, factory floors and refinery towers. With "A.W." Floor Plate, the first cost is always the last cost. Oil-proof, heat-proof, crack-proof . . . permanently safe. No worn and slippery surfaces to endanger men on foot. No cracks or ridges to upset floor trucks. Can be cut to any shape and installed *almost over-night*—that isn't a catch phrase, it's a fact. Write for folder.

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On The Assembly Line

BY W. F. SHERMAN
Detroit Editor

• Production edges upward due partly to coming holiday. Downturn considered unlikely until June. War dampens optimism as Detroit recalls automobile plants in 1918-19 produced shells, airplanes. Rubber a problem.

DETROIT—Production edged upward fractionally in plants throughout the automotive industry last week but no particular significance can be attached to the fact. Minor adjustments in schedules and the knowledge that the next week will be shortened by one or two working days because of the May 30 holiday brought about an increase of 550 units from the previous week's output of 98,480 cars and trucks. The total, 99,030 maintained this year's trend which is considerably above the level for a year ago when output for the corresponding week was 80,145 vehicles.

It has been remarked that automobile production finally seems set into a new pattern of stability. Despite objections from dealers that hardly have decreased in vociferousness in the five years since new model introductions were shifted from mid-winter to fall, there has been a change from the undeniably violent upswings and downswings of earlier production curves. Since the first of the year, the weekly output of the industry has never been far above or below the 100,000 mark. This is the only prosperous automotive year on record which shows continued high production through the winter months and absence of an unhealthy spring bulge.

Downturn Unlikely Until June

ONLY in the last two weeks has any softening been observed, and the actual downturn is unlikely to occur until sometime in June. With model runs scheduled to be completed in many cases by the Fourth of July, the industry promises tentatively that its production curve on 1940 models will approach the ideal that means better labor conditions, and more profitable operations for the manufacturer. In addition, those who have followed sales reports through the winter months can point to the fact that even the dealers have profited through stability. It appears that the well-balanced buying during the colder months can be accredited to a combination of consumer willingness, at last, to buy cars in winter time, plus economic influences which encouraged such buying, plus an enthusiasm for the 1940 design. Also, students of cyclic trends had predicted that demand for automobiles would be at its best in 1940.

The industry now poses the question of the European war's influence on summer and fall sales outlook. Optimism has been restrained and dampened since invasion of the Lowlands burst into the headlines. Detroiters still remember that the auto plants in 1918-19 were producers of shells and airplanes, not automobiles. Thoughts aroused by war news in the last fortnight have not had any direct effects on plans for the next year but many are waiting for their first look at sales totals for the middle ten days of May, the period which roughly coincides with the initiation of the total warfare across the seas. These sales totals which will be available shortly and figures for the final ten days of May might prove to be intensely significant.

War influences on supplies of materials used in automobile manufacture are weighed daily here. In addition to a possible shortage of Swedish steel wire for valve springs, it is considered possible that several other materials will be restricted or cut off by war. One manufacturer has used oil pump gears made of Swedish sponge iron.

Of course, in this case the material is not vital because the return to former manufacturing practice and materials can easily be effected. However, it appears probable that the use of an interesting new process will be halted abruptly for the duration of the war.

Detroit eyed with concern the word last week—from the Rubber Manufacturers Association that enough crude rubber to supply the United States for just about five months was in domestic warehouses and enroute to America by ship at the end of April. The Netherlands East Indies and British possessions in the Far East have been principal suppliers. Domestic stocks were estimated lower than inventories a year ago but rubber in transit amounted to nearly twice as much. Warehouse tonnages were said to be 162,282 long tons at the end of April, compared with 142,414 the previous month and 188,074 a year ago. Afloat were 102,557 long tons compared with 113,619 at the end of March and only 57,918 at the end of April last year. Consumption in the United States approximates 50,000 tons a month. According to the rubber trade, five or six months reserve is considered normal.

Because tungsten supplies are involved in China's war, steps are being taken in some quarters to avoid possible difficulties which would be caused by shortage. One manufacturer of cutting tools is swinging over rapidly from tungsten high speed steel to molybdenum tools steels successfully. Performances reported as satisfactory with lower weight, lower cost and more assurance of delivery given as reasons for the change.

Fear of Industrial Diamond Shortage

ALREADY mentioned in the "Assembly Line" (May 2, 1940) are the fears that industrial diamonds and crushed bortz supplies might be exhausted eventually. One source, in a routine and unprejudiced note to a Detroit dealer estimated the readily available supplies as sufficient for 18 months.

Designs are rapidly taking final shape and 1941 production programs are for the most part settled by now. An up-to-the-minute summary would show that the Ford 6-cyl-

DRILLS *plus* BRAINS *produce* PROFITS

Once this operation required two drills and two jigs — twice the expense, twice the time. Not now, though. A G. T. D. Greenfield engineer suggested a special step-drill and as a result, a certain plant foreman is congratulating himself on a substantial cost reduction.

Here's the point: G. T. D. Greenfield engineers are continually analyzing actual threading, drilling and reaming operations in plants of all types. They acquire a vast fund of practical ideas which they can bring to any manufacturer who seeks their advice. Sometimes a variation in even such points as speed or lubricant will mean savings as substantial as those which involve actual tool design. Give your friend, the G. T. D. Greenfield engineer, a chance.

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inder engine has not been taken off the shelf where it was quietly placed some weeks ago. But body die work has not been halted and a logical conclusion, although unsupported, is that the new Ford chassis and body will ride the highways next year with the 60 hp. V-8 engine under the hood. Changes on other Ford models do not look like major ones.

In the General Motors line-up the Torpedo type of styling will take over almost completely. The automatic transmission of the Olds Hydra-matic type appears definitely scheduled for the big Buick, Cadillac and La-Salle. The program has reached the stage where orders are being placed for the manufacture of parts for the transmissions for some of these cars. Use of the transmission widely throughout the General Motors organization is not scheduled and probably will not be until 1942 models are planned.

Manufacturing difficulties have beset the Detroit Transmission plant and even hindered deliveries so the inclusion of a few of the more exclusive cars, plus a truck transmission of the same type, will provide a sufficiently ambitious program for the next 12 months. The aforesaid means undoubtedly that General Motors will not erect a proposed new plant for Detroit Transmission on the outskirts of the city near the new diesel plant.

Chrysler, however, is rapidly nearing completion of the building where fluid flywheels and transmissions will be built in volume for next year's cars. Besides the Eights, all of the Sixes in the Chrysler line will be offered with fluid flywheels. The Plymouth Road-king, lowest priced car in the Chrysler line, is a likely exception. An improved transmission is slated for Dodge. Rumor says this will be the float and climb type transmission with liberal application of roller bearings.

Because Detroit has been a center of mass production activity the area is full of news of the mass production plans of the aircraft industry and of machine tool manufacturers who are loaded with orders. It is known here that scores of plane, engine, and machinery manufacturers have been exploring the prospects for expanding their plants and multiplying capacity.

So far the extent of military procurement activity in this immediate area has been encompassed in the orders for Dodge and General Motors trucks which were placed last fall and on which production is now tapering off or nearly completed.

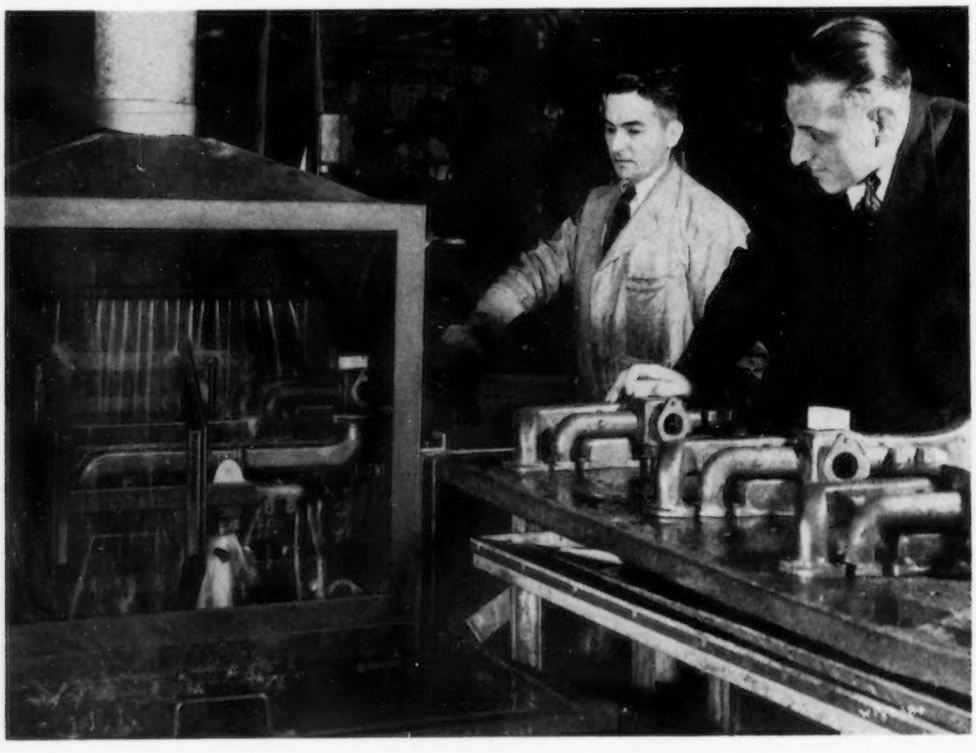
In addition there have been numerous educational orders and a few actual production orders for shells, five-pound aerial bombs and machine gun parts.

Rumor, after the President's proposals for 50,000 airplanes and tremendous expansion of mobile equipment, brought forth newspaper stories that $50,000,000 in war orders were slated for release soon in Detroit.

Automotive people greeted with denials Friday all rumors that new huge truck orders had been already placed here and discounted sharply the report that 300,000 trucks and 1500 tanks had been ordered.

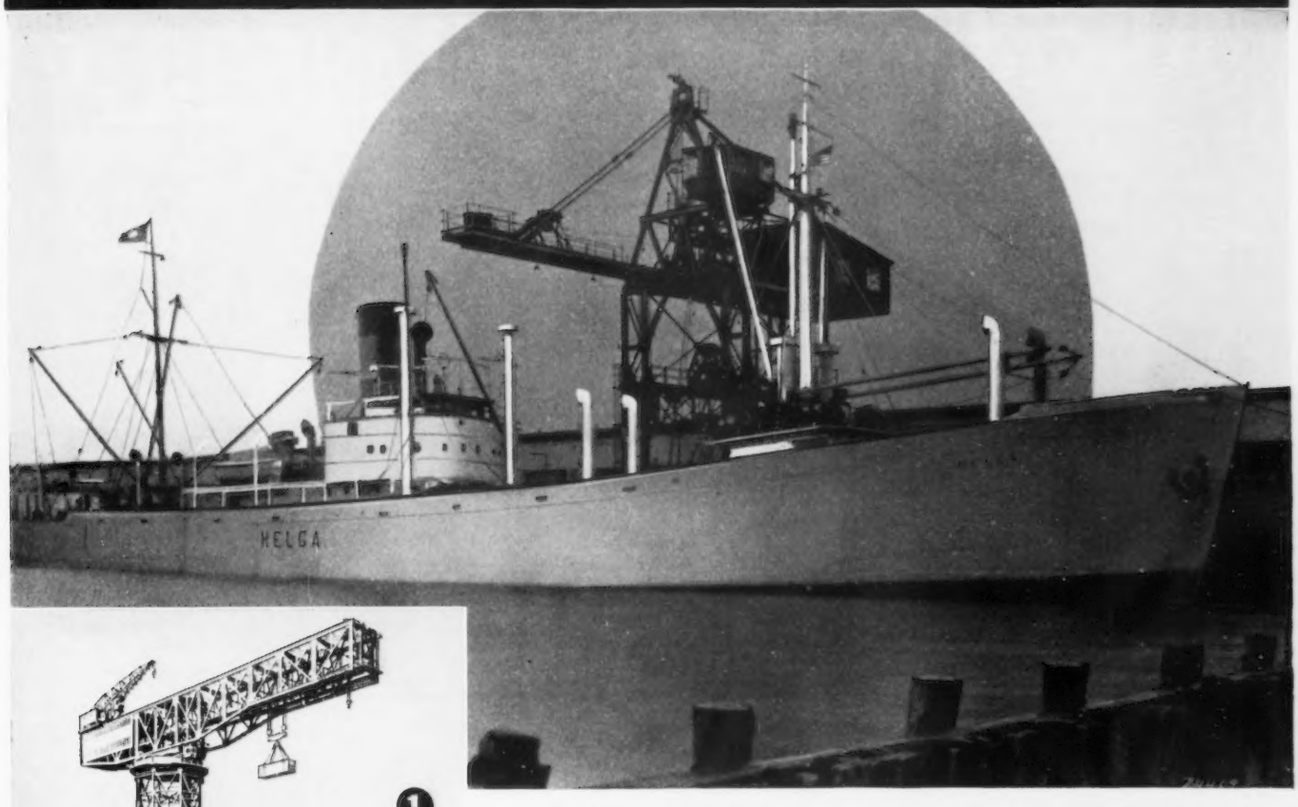
Further, it is not considered likely here that any orders for heavy tanks will be placed with auto plants. Instead, experts look to shipbuilding concerns to handle the heavy steel plate work that would be involved.

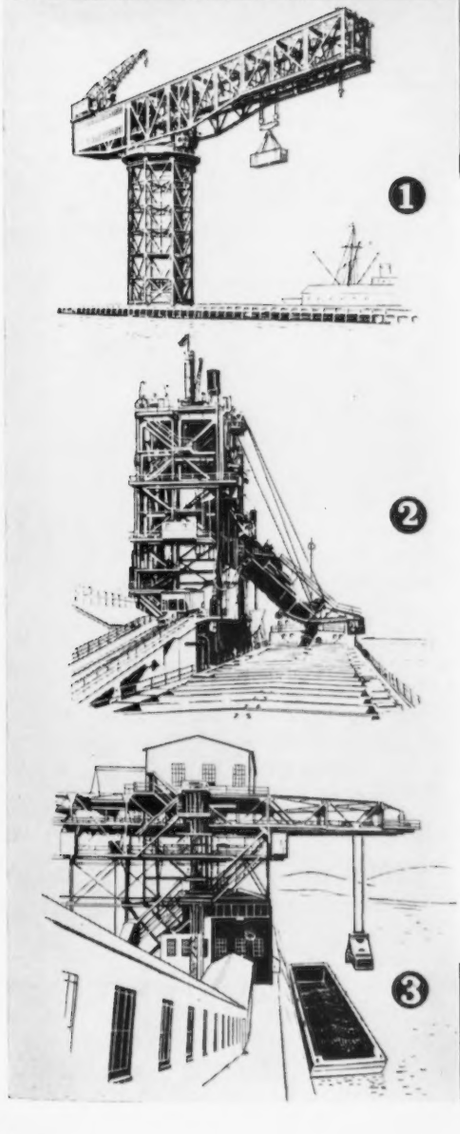
On the other hand, one important development arose late in the week at General Motors truck plant at Pontiac. Bids were taken at noon on Friday for 420 tons of structural steel to be used in a new GM truck.



NEW washing equipment for automotive cylinder blocks, heads and manifolds has been installed at the Plymouth plant in Detroit. Otto Franke, Plymouth master mechanic (right), here has removed one side of the manifold washer to show the revolving fixture which holds intake and exhaust manifold assemblies for the washing operation. The manifolds are loaded in the fixture at the top position and receive four complete washings of 10 sec. each at four stops as the fixture indexes through 360 deg.

MATERIALS HANDLING





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Washington

BY L. W. MOFFETT
Washington Editor

• Shipbuilders warn Walsh-Healey, other laws hamstring defense drive as Roosevelt asks for 50,000 fighting planes, requests billion for Army, Navy. Financing left to Congress. RFC may aid purchasing

WASHINGTON — Directing attention to the fast military developments in Europe as pointing to the possibility of attack on vital American zones, President Roosevelt's message before a tense Congress last Friday forewarned industry to be prepared to speed up to a 24 hr. basis all existing Army and Navy contracts and all new contracts to be awarded from appropriations of $896,000,000, which he asked be supplied at once.

As the President urged, in effect, that the nation be put quickly on a semi-war footing, industry was making it clear that to do so it would be necessary for the government to lift rigid wage and hour restrictions. Leading this move in conjunction with Navy Department officials were shipbuilding executives who on the day preceding the President's national defense message told the House Naval Affairs Committee, concerned over the progress of the shipbuilding program, that it was being seriously impeded by the Walsh-Healey, Federal 8 hr. and Fair Labor Standards acts.

While specific reference to full shift operations, contained in the prepared address, was omitted by the President in the delivery of his message, it was said at the White House that the omission was inadvertent and that the text stood as written.

Must Prepare For Top Speed

FACILITIES for production must be ready to turn out munitions and equipment at top speed, President Roosevelt told the legislators, as he discussed types of matériel which he wants rushed to completion in the shortest possible period. He made it clear that large as well as special kinds of tonnage and metal working machinery will be required. Also involved in some units will be expansion of facilities, especially necessary if the President's desire to gear aircraft output up to 50,000 units a year, the number laid down in the program, is to be attained.

Nevertheless, Col. John H. Jouett, president, Aeronautical Chamber of Commerce, said that by tripling the floor space of aircraft plants, doubling the area of aircraft engine factories, multiplying the present number of employees by three, and operating all plants on a full-shift basis, the U. S. aircraft industry can produce 50,000 military planes a year.

The President pointed to expansion already made as giving promise of accomplishing his objective, when he said that "during the past year American production capacity for war planes, including engines, has risen from approximately 6000 planes to more than double that number, due in greater part to the placing of foreign orders." He had previously asked Congress not to "in any way hamper or delay the delivery of American-made planes to foreign nations which have ordered them." On the basis of the President's estimated present capacity, it is not quite 25 per cent of that he wants to be built up.

While expansion of productive capacity will have to be paid for by the government, the means of doing so, like the means of financing the national defense as a whole was left to Congress.

Meanwhile it is said that RFC loans are under consideration for concerns which will be called upon to purchase requirements necessary to produce national defense needs for the Army, the Navy, and the Marine Corps. Army appropriations requested totaled $546,000,000 while $250,000,000 was asked for the Navy and Marine Corps, supplemented by $100,000,000 for the President himself for unnamed "emergencies."

Indicating both the large quantity and types of matériel wanted and asking for expeditious delivery, the President said the ground forces of the Army require the immediate speeding up of last winter's program to procure equipment of all kinds, including motor transport and artillery, including aircraft guns and full ammunition supplies. It has been planned, he said, to spread these requirements over the next three or four years.

"We should fill them at once," he declared.

The Navy program also calls for increased supplies of all kinds, including ships and equipment, while the Marine Corps will be supplied with increased military equipment of all the kinds it uses.

Additionally he asked for $286,000,000 in authorizations, $186,000,000 for the Army, Navy and Marine Corps to make contract obligations and $100,000,000 for the President to make contracts.

Used For Plants, Training Pilots

"IT is my belief that a large part of the requested appropriation of $100,000,000, and the requested authorization of $100,000,000 to the President will be used principally for the increase of production of airplanes, anti-aircraft guns, and the training of additional personnel for these weapons. This would be in addition to the direct estimates for these purposes in the other items requested," Mr. Roosevelt said.

"The proposed details of the appropriations and authorizations asked for will be given to the committees of the Congress.

"These estimates do not, of course, duplicate any item now in the pending War and Navy appropriation bill for the year 1941. Nor do they include supplemental or deficiency estimates which may become necessary by reason of legislation or shortage of funds under existing programs."

Called before the House Naval Affairs Committee to suggest methods by which the naval shipbuilding program can be speeded in view of world developments, members of the shipbuilding industry last Wednesday recommended relaxation of wage and hour and other Congressional restrictions imposed on government contractors. Key Navy Department officials made similar suggestions, proposing a speed-up plan to cost $300,000,000 and advancing a 24 hr. day and a 48 hr. week of three shifts as a requisite. Admiral Samuel H. Robinson characterized the labor angle as the nub of the whole problem.

The inquiry, an unusual one, was prompted by a growing conviction in Congress that the shipbuilding program is proceeding at too leisurely a rate. The circumstances under which representatives of the shipbuilding industry were called to Washington suggested that the Administration is taking industry into its confidence to an increasing degree.

Members of the committee, many of whom joined with other members of Congress during the last six years in subjecting government contractors to greater burdens for the benefit of labor, agreed that relaxation may be necessary.

Chairman Carl Vinson, in summarizing the steps recommended for speeding the shipbuilding program by implication at least indicated that President Roosevelt would be asked to relax the requirements of the Walsh-Healey Public Contracts Act—a move which could be made under emergency conditions obtaining at present without the necessity for Congressional revision of the law.

The Walsh-Healey law, the Federal 8-hr. law and the Fair Labor Standards act were mentioned repeatedly during the session as serious deterrents to the shipbuilding program. H. G. Smith, president of the National Council of American Shipbuilders, told the committee that restrictive legislation, especially the Walsh-Healey law, seriously affected suppliers and required prompt consideration if the country is to embark on a "real emergency" defense program. He testified, however, that changes ordered after construction had been started was by far the most serious cause for delay.

Industry representatives pointed out that in attempting to remove certain bottlenecks some sacrifices would have to be made. They suggested these steps be taken:

(1) Less centralization in Washington so that Navy inspectors could approve or reject details on the job; (2) Reduce to a minimum the large number of tests which have been developed in recent years but which could be dispensed with to advantage without adversely affecting the completed job; (3) Relax present maximum hour requirements on the shipbuilder and his sub-contractors; (4) Revise present competitive bidding requirements so that yards best equipped to turn out a particular type of ship be given all future contracts so far as possible for that type of vessel; (5) Give assurance to contractors that they will be paid for additional plant expansions made necessary by large volume of government orders.

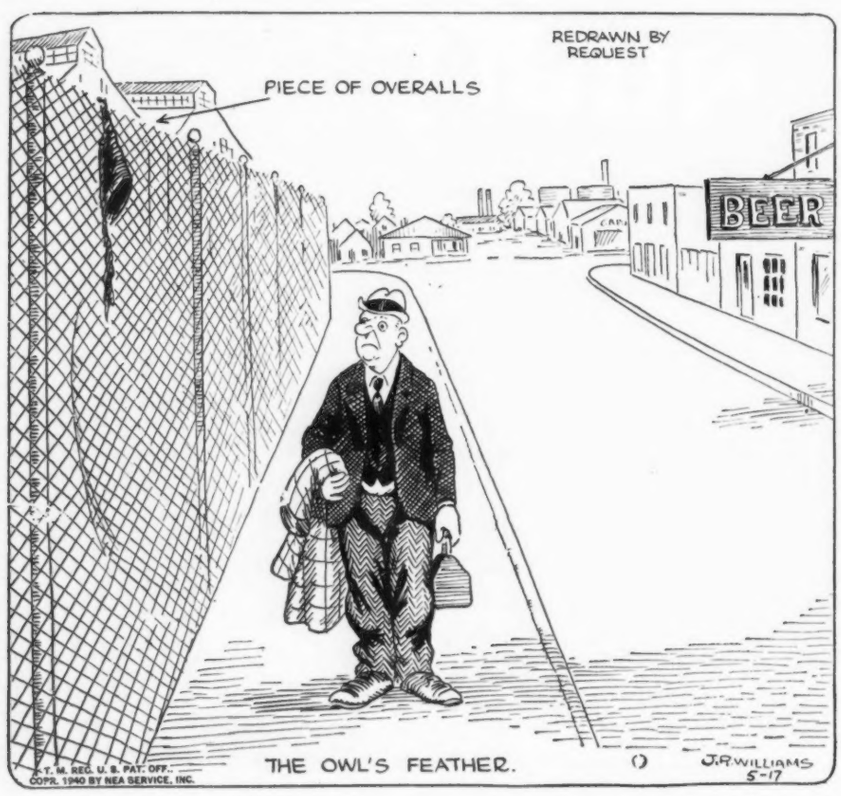
Three methods were discussed at the hearing for treating the element of cost in plant expansions. Mr. Smith suggested the Navy purchase the necessary equipment and retain title—a plan which was followed last year when Congress permitted the Navy to dip into its 1940 shipbuilding funds and buy special heat treating equipment, title remaining in the Navy, to be installed in plants having armor plate contracts.

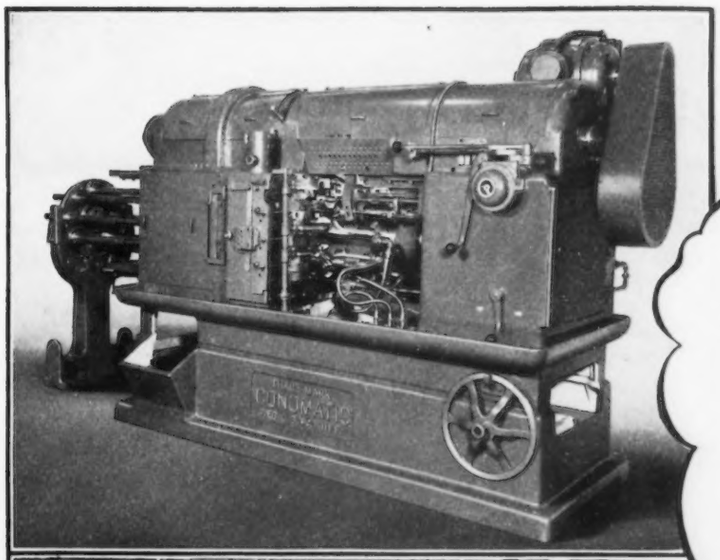
Chairman Vinson registered preference for a method under which the contracting companies would purchase the equipment and depend upon future government contracts for writing off the expense. He said he recognized that the difficulty under such a system would be the question of whether future government contracts necessary to write off the cost would be forthcoming.

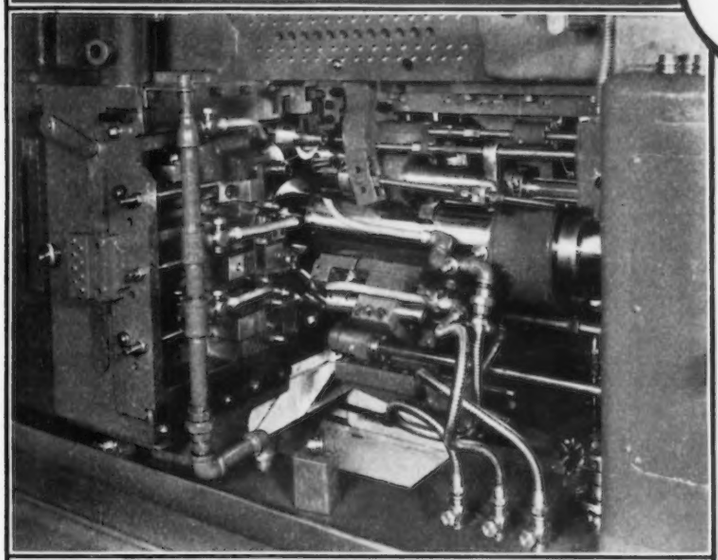
A. B. Homer, vice-president in charge of shipbuilding, Bethlehem Steel Co., urged the adoption of a policy whereby plant expansions would be paid for in the contract for which the added facilities are first required. After suggesting that unrestricted weekly hours be permitted, the witness recommended that the Navy inaugurate a plan to assist sub-contractors to expand facilities "so they can become better sources of supply."

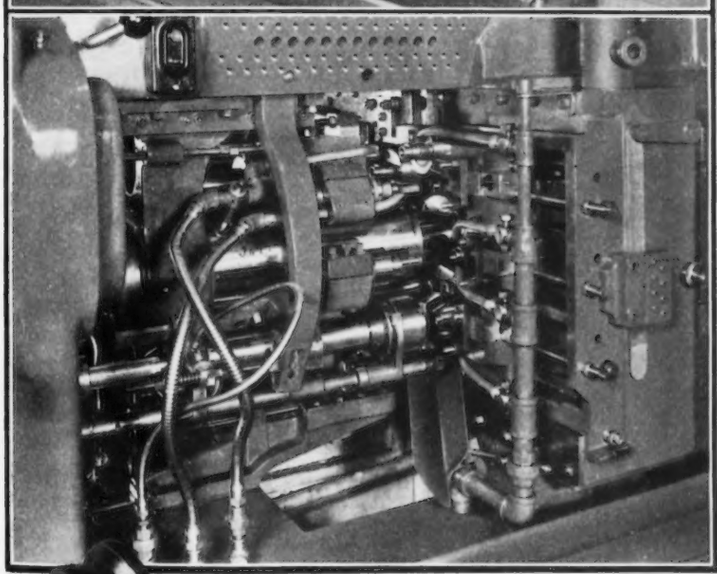
Mr. Homer told the committee his company is best equipped to build battleships and cruisers and revealed that the Bethlehem company had submitted a plan to the government under which its shipbuilding facilities could be used to advantage in a heavier shipbuilding program.

THE BULL OF THE WOODS — BY J. R. WILLIAMS









TOUGH JOB TOUGH STOCK —so they used a CONOMATIC

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If you have a tough screw machine problem send it to Cone. Recommendations on machines and tooling will be made without obligation.

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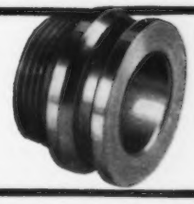

News of Industry . . .

Grainal, New-Type Alloy, Announced By Vanadium Corp.

• • • **Discovery of a group of** new-type alloys designed to assist the steel maker in meeting more easily high specification limits required by the automotive, armament, machinery and other large industries is announced by E. D. Bransome, president, Vanadium Corp. of America, New York.

The name "Grainal" has been given to these alloys which are said to act to give positive control and uniform results to the steelmaking process.

By the addition of only a few pounds, in some cases as little as 2 lb. of one of these alloys to a ton of steel, ordinary carbon steels and the very low alloy steels attain the hardness and other important physical characteristics of more highly alloyed steels, Mr. Bransome says.

"We believe that this new group of materials, if the experimental work that has been done is fully borne out in their commercial application, will make an important contribution to the art of steelmaking," Mr. Bransome declares.

"It is worth noting that alloys of this type may be made from ores readily available in the United States." The new group of alloys, Mr. Bransome reports, was discovered by research engineers of the corporation in their studies to develop more effective and econmical combinations of alloying elements for steels used for machinery and other purposes requiring hardened steels. This particular group of alloys was the subject of research for more than three years before actual field work was started.

"For more than a year now, Grainal has been subjected to tests in various of the large steel plants of the country," Mr. Bransome says. "The steels turned out in these experimental heats have further been subjected to rigorous scrutiny by many of the larger users of steel in this country, such as the automotive and farm implements industries.

"In the introduction of this new group of alloys, we are of the opinion that we are moving into a second phase of the development of the alloys industry. In the first instance, this industry was based on supplying materials which, when added to steel, had as a result of their being a part of the steel's composition specific effects on the physical properties of the finished product.

"The thought has been expressed that in addition to de-oxidation for which other alloys are also available, the new Grainal alloys contribute to the fixation of free nitrogen, the presence of which has been widely recognized as contributing to variable results in finished steels of otherwise identical physical and chemical properties," the Vanadium executive reported.

Republic Finds A Pyridine Trap

Cleveland

• • • **Republic Steel Corp.** engineers have developed a tiny pump and bulb-shaped saturator which trap the gas from coke ovens and draw off its pyridine content. This will help increase the supply of sulfapyridine, valuable in the treatment of pneumonia.

Republic has applied for a patent on its developments, said to increase by more than 90 per cent the amount of pyridine recovered from each ton of coke baked in their ovens.

Coincidentally, engineers of Reilly Tar & Chemical Corp. have perfected a more efficient method for conversion of pyridine into sulfapyridine. Through the old batch process, engineers were able to salvage about 50 per cent of the total output, or about one ounce from each ton of coke burned. With the new process of continuous removal, the salvage ratio has been increased to about 96 per cent, or approximately two ounces for each ton of coke, according to M. D. Wald, superintendent of Republic's by-product plant.

The new method was inaugurated in the Cleveland plant in February, and has since been installed in the Warren, Youngstown and Buffalo plants.

U. S. Steel Adopts Pension Plan For $3,000 Plus Group

• • • **A new pension plan for** employees whose earnings exceed $3,000 a year has been adopted by U. S. Steel Corp. in a step making pension coverage available to all the corporation's employees, B. F. Fairless, president, announces.

Under a Contributory Pension plan now established employees participating will contribute 3 per cent of their earnings in excess of $3,000 a year—$3,600 in the case of railroad employees—and the employing subsidiary companies will provide such varying amounts as may be required to cover the cost of the plan.

Approximately 11,000 employees are eligible under the new contributory plan, which is intended to provide an annual pension for life, upon retirement at age 65, of one per cent of the aggregate eligible compensation (amount in excess of earnings taxable under the Federal pension laws) received by an employee during participation in the plan.

"As in the case of the Federal pension plans, where the cost of public pensions is provided by the joint payments of employees and employing companies, through taxation, cost of the pensions under the corporation's new plan will be met by contributions of participating employees and payments of the employing companies," Mr. Fairless said.

Earnings under $3,000 yearly will not be affected since such earnings are covered by the Federal pension laws—the Social Security Act and the Railroad Retirement Acts.

The U. S. Steel Corp. has provided retirement pensions to employees since 1911. When the pension rules were revised last December, in anticipation of the announcement of payments under the Social Security Act in January, 1940, provision was made to continue pension credits for service prior to 1940. These provisions, the corporation announces, are not affected by the U. S. Steel Contributory Pension Plan.

Consumers Obtain 30% More—And Better—Steel for the Same Money

—*Brookings Institution*

Washington

• • • **Increases in productive** efficiency in the steel industry since the early 'twenties have brought benefits to consumers now amounting to around $389,000,000, according to a survey of productivity by Dr. Spurgeon Bell at the Brookings Institution.

A comparision between the periods, 1923-24 and 1936-37, shows that in the latter period the consumer got approximately 30 per cent more iron and steel products for the same money. In addition there were important gains arising from improved quality.

The survey was part of a larger study of productivity, wages and national income in major divisions of industry, which was financed by the Falk Foundation, Pittsburgh.

Productivity per man-hour increased approximately 56 per cent during the entire period. Of this increase 35 per cent took place in the 'twenties. During the 'twenties, output kept pace with the rise in productivity, hence employment was maintained. Despite a material decline in output after 1929, there was a rise for the whole period of 29 per cent, Dr. Bell reports.

Man-hours of employment declined 17 per cent between 1923-24 and 1936-37, but the number of wage-earners increased by 14 per cent, reflecting the reduced number of working hours per week. In 1937, although production was below the level of 1929, the number of workers employed was approximately 20 per cent above the 1929 figure.

Over the entire period, hourly earnings, in dollars, did not rise as much as the output per man-hour. Real hourly earnings, however—earnings in buying power — approximately kept pace with the increased output per man-hour, inasmuch as there was a substantial decline in living costs. And, despite the reduction in working hours, "real" weekly earnings increased, although dollar weekly earnings declined somewhat.

In summary, the chief gains from increased productivity went to consumers in the form of lower prices and better products, and to labor in the form of more leisure, according to Dr. Bell.

The amounts received by the several groups who share in the income of the industry are shown in the following table, setting forth the tops and bottoms of cyclical fluctuations (in millions of dollars):

Years	*Income*	*Wages*	*Salaries*	*Earnings on Capital*
1920	1,905	1,255	279	371
1921	820	570	179	71
1929	1,758	1,036	220	502
1932	194	257	82	145
1937	1,519	1,057	198	264
1938	794	604	170	20

Earnings on capital showed much greater fluctuations than the other shares. They rose much more during increasing prosperity and declined much more in periods of depression.

French Tank Order Places Heil Plant on Three Shifts

Milwaukee

• • • **The Heil Co.,** with an order for 145 tanks to be used on French army trucks being made by the White Motor Co., is operating three 8-hr. shifts in some departments, employs about 1000 men and has added some 200 in the last month. Heil now is turning out eight of these tanks a day, each unit having a capacity of 4755 gal. of fuel.

Coming Meetings

May 23—American Iron and Steel Institute, annual meeting, New York.
June 3 to 6—Annual international convention and Inform-a-Show, National Association of Purchasing Agents, Cincinnati.
June 6 and 7—Grinding Wheel Manufacturers Association and Abrasive Grain Association, Niagara Falls, N. Y.
June 17 to 20—American Society of Mechanical Engineers, semi-annual meeting, Milwaukee.
June 24 to 28—American Society for Testing Materials, 43rd annual meeting, Atlantic City, N. J.

Making of Wire Rope Shown In New Bethlehem Film

• • • **Bethlehem Steel Co.,** which added manufacture of wire rope to its activities three years ago, is now completing an industrial motion picture on the making and use of this product. With acquisition in 1937 of the Williamsport Wire Rope Co., Williamsport, Pa., now the Williamsport Division, Bethlehem became one of the few manufacturers of wire rope having its own steel making facilities.

Beginning with iron ore handling, the new picture, "Sinews of Steel," will show the principal operations in steel making.

"Sinews of Steel," will be a sound film, four reels in length and in 16 mm. size. It is being made for presentation at meetings of jobbers and dealers, technical societies, trade associations, and college and representative civic groups.

Rockford Company Sold In $2,000,000 Transaction

Rockford, Ill.

• • • **In a $2,000,000** transaction, Consolidated Industries, parent corporation of the Sewing Machine Co. and other companies, has been sold to Jay Kasler, head of a Toronto, Can., investment firm bearing his name. Morely and Harold Kasler, with Samuel C. Rudolph, who have been active in the management of Kasler Pacific coast properties, will operate the Rockford industries. Immediate expansion of the sewing machine factory has been announced.

Houghton Co., Manufacturer, Gives Gold Service Emblems

• • • **Gold service emblems,** in observance of the company's 75th anniversary, have been given employees of E. F. Houghton & Co., metal working products, oil, and leather company, Philadelphia. Three hundred and twenty-four men and 77 women employed for from 10 to more than 30 years, received the emblems. The Houghton company's service to the metal industry includes research publications like "Steel and Its Treatment," and "Practical Metallurgy for Engineers." Recently the company developed an anti-piping compound to increase ingot yield in steel making.

Welding Research Group To Study Building Field

• • • **Formation of a** Structural Steel Welding Research Committee to study problems of design and fabrication in the building field is announced by the Engineering Foundation, research organization of the national engineering societies.

The program includes the establishment of research fellowships in American universities. The first goes to Lehigh University for a 2-year period and the investigations will seek to develop a satisfactory design procedure for beam-to-girder and beam-to-column connections for all kinds of welded building construction.

Work of the committee will be to obtain basic data which will enable fabricators to apply welding in building with greater safety and with greater economy. By obtaining information on effects of varying loads on welded connections, the committee hopes to perform a service for building engineers.

Leon S. Moisseiff, consulting engineer, New York, has been chosen chairman. Other members are: F. H. Frankland, technical director, American Institute of Steel Construction, New York; Jonathan Jones, chief engineer, fabrication division, Bethlehem Steel Co., Bethlehem, Pa.; C. H. Goodrich, chief engineer, American Bridge Co., Pittsburgh; A. S. Low, vice-president, Austin Co., Cleveland; Commander C. A. Trexel, design manager, Bureau of Yards and Docks, United States Navy, Washington; La Motte Grover, engineer, Air Reduction Sales Co., New York; and Prof. Bruce Johnston, Lehigh University. H. W. Lawson, engineer, Bethlehem Steel Co., and F. H. Dill, engineer, American Bridge Co., have been named alternates.

Sloan Fellowships Go To 11 Young Industrialists

• • • **Award of eleven** Alfred P. Sloan Foundation Fellowships ($2,500 each) for a special one-year program in economics and administration to be undertaken at the Massachusetts Institute of Technology has been announced by Dr. Karl T. Compton, president of the institute. The recipients are all young executives nominated by industries in all parts of the country and will return to their companies upon completion of the program. Two hundred seventy-nine companies entered candidates in the series of annual competitions of which the third has just closed.

Firth-Sterling's Plant is Inspected by Wire Assn.

Pittsburgh

• • • **More than** 250 members of the Wire Association and guests last week inspected the very interesting tungsten carbide manufacturing division of the Firth-Sterling Steel Co., McKeesport, Pa., where the process of the manufacture of tungsten dies for wire drawing was observed and described.

Following the inspection trip the group, which is composed of representatives of the wire manufacturing industry, who met at Pittsburgh for a regional meeting, were guests of Firth-Sterling at a dinner.

At the evening session of the wire association L. W. Winkler, chief metallurgist, Bethlehem Steel Co., discussed a number of different aspects of wire galvanizing; R. M. Hussey, superintendent of wire works, Jones & Laughlin Steel Corp. talked on cleaning and cleaning problems; and H. L. Hopkins, chief metallurgist, National Machine Screw Mfg. Co. presented an interesting and informative paper dealing with the cold heading of wire. Phases of the problem covered included types of wire commonly used, cold heading methods and techniques, etc.

Complete List of Kaiser Wilhelm Institute 1939 Bulletins

• • • **The collection of 1939** bulletins of the Kaiser Wilhelm Institute for Iron Research is now complete. It consists of twenty-three bulletins. As usual, they are mostly metallurgical, but they also contain some physical, chemical, and mechanical treatises. The total number of pages is 351. Only the main headings can be given here. They are:

1. Alternating stress by tension and compression, bending and torsion in steel bars having cross bores and notches. Price 4.75 marks.

2. The desulphurization of pig iron with alkalies, I. 5.75 marks.

3. On the decomposition of austenite in a vanadium steel in undercooled condition; breaking-down rate and structure as a function of former treatment and decomposition temperature. 2 marks.

4. The application of the polarograph in the iron and steel laboratory. 2.75 marks.

5. The reactions of high-carbon iron manganese heats with iron oxides, iron sulphides and silicates at temperatures of 1300 to 1400 deg. C. (Laboratory tests for the production of slags rich in manganese.) Price 5 marks.

6. On a magnetic method for testing the quality of heat treating of finished goods. 2.25 marks.

7. Behavior of hot steel under alternating tensile and compressive stress. 3.75 marks.

8. Influence of the rate of cooling on the transformations and properties of chromium steels. 3.50 marks.

9. On the problem of fatigue fractures. The use of magnetized powder for finding the starting of a crack. 3 marks.

10. Determination of forward slip in hot rolling. Hot-rolling tests made with carbon steel and three alloy steels. 3.25 marks.

11. Problem of steel hardening, considering particularly the influence of the quenching medium on the processes of hardening.

12. Conversion of elongation at fracture for different measuring lengths of alloy steels.

13. On primary crystallization of steel. Limits of undercooling, and nucleus formation in the liquid state.

14. The behavior of material with internal stresses when

subjected to various alternating stress.

15. Impact strength of alloy steel at temperatures from plus 20 C. down to minus 250 C. (boiling temperature of hydrogen). Hardness tests and tensile strength of alloy steels at low temperatures. 4.50 marks.

16. How to avoid loss of manganese in the open-hearth process. 3.50 marks.

17. Elastic anisotrophy and measurement of stress by X-rays. 2 marks.

18. The magnetic properties of roasted iron carbides and their beneficiation by changing the conditions of roasting. 3.50 marks.

19. Determination of two-dimensional stress conditions from a single X-ray exposure. 1 mark.

20. The methods for measuring stress by X-rays. 3 marks.

21. The penetration of hardness in chrome-molybdenum and chrome-nickel steels. 3.75 marks.

22. Spectro-analytic determination of elements in sparks by direct photo-electric measurement of line intensities.

23. The reactions of iron sulphide with oxides, carbonates, silicates, and phosphates in the presence of carbon in the heating of powdered aggregates.

These bulletins and the research work which they describe were prepared with the usual thoroughness and represent the top notch of ferrous metallurgy. While their study is recommended, it will be very difficult for anyone to obtain these bulletins under the present conditions of interrupted mail service, W. Trinks, of the Carnegie Institute of Technology, points out.

Motor Companies Renew Pay Contracts With AFL

Milwaukee

• • • **Harley-Davidson Motor Co.** and the Wisconsin Motor Co. have renewed labor agreements with the AFL, the Harley-Davidson pact covering 1000 workers and calling for some vacation increases, with provisions that the firm will not hire married women and that unmarried women employees must retire upon marriage. The Wisconsin Motor agreement covers 300 workers, lifts wages for 150 and increases vacations. The NLRB order that International Harvester Co. disestablish its six independent unions will be fought in court if an appeal to the board is denied, Sydney G. McAllister, president, said.

• • *AN "Open House" held May 11 by Joseph T. Ryerson & Son, Inc., Chicago, drew more than 3000 customers and friends to the company's plant for a buffet luncheon and inspection trip*

Cone Drive Gear Sales Show 94 Per Cent Gain

• • • **Sales of Cone Drive** worm gearing for the first quarter of 1940 showed an increase of 94 per cent compared to the first quarter of 1939, according to the Cone worm gear division, Michigan Tool Co., Detroit. Indicative of the growing industrial demand for this relatively new type of gearing, the first quarter closed with unfilled orders on hand totaling three times total Cone-drive sales for the entire year of 1939. The year of 1939 in turn had shown an increase of better than 55 per cent over 1938.

Cyclone Fence Co. Buys Savannah Wire Cloth Mills

Cleveland

• • • **Purchase of the** Savannah Wire Cloth Mills by Cyclone Fence Co., subsidiary of U. S. Steel Corp., from the Port Wentworth Corp. was announced this week by C. F. Hood, president of Cyclone, and Robert M. Nelson, president of Port Wentworth. The Savannah mills, located near Savannah, Ga., make electro-galvanized steel screen wire and bright bronze screen wire, both of which are woven in 16 and 18 mesh.

R. E. Pinniger, vice-president and general manager of Cyclone Fence, said it is intended to continue operation of the Savannah plant.

Peru Studies Proposal for Domestic Steel Industry

Washington

• • • **Establishment of** a domestic steel industry in Peru recently has been the subject of discussion in the Peruvian Congress, says a report from the office of the American commercial attaché, Lima. Some authorities favor locating the proposed industry in the Chimbote district; others prefer the Callao district. Proponents of the project believe that if a steel industry is to be established in Peru it must be financed, at least in part, by the Government, and organized to produce products for export, because of the relatively small national consumption of iron and steel products.

Industrial Centers Fight Defense Bottlenecks

Pittsburgh

• • • **The steel industry** is in position to meet the requirements of the President's demand for 50,000 planes if it utilizes the time between now and when the orders will start to flow, by expanding its production and process control in the making of alloy steels.

By
T. C. Campbell
Pittsburgh Editor
The Iron Age

Further training of skilled workmen in the handling and processing of alloy steels from ingot to finished steel shapes is necessary, in order to take care of the unprecedented demand for high grade steels that is in the offing.

With alloy steel production in the nation at top speed, due to plane order backlogs, the additional business that will follow as the result of the preparedness program assures peak production of alloy steel for some time to come. Regardless of the outcome of the European war it is expected that the domestic plane business will go forward.

With one large Ohio plant entering the electric steel production field and with increased electric furnace capacity planned or recently put into operation, no alarm is felt that the steel industry can not meet Government requirements in its defense measures.

Processing of the ingot down to the billets and bars and other shapes can be adequately taken care of by existing rolling mills but because of the rigid specifications and the frequently sensitive nature of alloy steels, precise process control can only be assured by an intensive training program for the present skilled working forces. Such programs are already going forward at some plants with others expected to start immediately.

The average large type bomber takes about five to six tons of alloy steel shapes. This tonnage of course does not represent the amount of steel that goes into the plane but is a reliable estimate of the volume of bars, sheets, strip, etc., that are machined into airplane parts and engines. Likewise such a bomber would require about six tons of aluminum plates, shapes, bars, etc., to be machined into parts in addition to the tonnage of alloy steel required.

Figuring on the basis of 50,000 planes in addition to those already on order, an impressive total backlog for alloy steels and aluminum is in the offing. In fact there is a possibility that some kind of allocation of alloy steel to be sold in the market might materialize in view of the fact that United States Government orders will get preference over domestic demand.

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Midwest Plants Hunt in Vain For More Skilled Workers

Cleveland

• • • **Some idea of the** problems to be faced in building up this nation's military defense in a hurry may be perceived here, where a broad cross section of industries exists, with around 80 companies contributing to the aircraft industry.

By
D. R. James
Cleveland Editor
The Iron Age

In order to quadruple the output of American airplanes, which would be necessary to achieve the goal mentioned by President Roosevelt, training skilled workmen will be perhaps the greatest of the problems. This involves obtaining supervisors and instructors, as well as getting reasonably intelligent men and women to train. Securing adequate manufacturing facilities, including plant space and machines, may consume considerable time.

SHOWN here are members and guests attending the spring convention meeting of the Associated Machine Tool Dealers of America, held last week at the Hotel Claridge, Atlantic City. Those at the convention visited • •

Clearly a new Middle Western attitude has resulted from world events of the past two weeks. Northern Ohio industrialists appear quite concerned over the necessity of bolstering our defenses. Previously, relatively little on the subject was heard out here, even though the machine tool and aircraft parts industries had been rolling up backlogs for many months. It is generally regarded as essential that supplies and equipment for the Allies must be kept moving to them.

A shortage of skilled personnel exists now here. For weeks and weeks tool makers have been sought by some companies in vain. Training of youthful machine operators is being undertaken on a large scale. The next step, in the opinion of many industrialists, will be the training of intelligent women for machine operation, inspection and other positions. Supervision presents a serious problem.

If necessary, automotive manufacture could be "frozen" to present models, freeing many tool makers. Standardization can be expected in many other fields, including the steel industry, where thousands of analyses could be eliminated in an emergency.

Machine tool producers here during the past week have noticed a definite upturn in both inquiries and orders, the result of conviction in the minds of prospective buyers that heavy wartime demand is at hand. Vacant spots in production schedules are being filled up quickly.

Steel makers look for a tight situation if Allied buying keeps up, coupled with increased domestic demand. The latter has been good, but lacking support from two major industries recently, the auto industry and the railroads. Both these fields have large scale buying to do in succeeding months this year.

Alloy steel particularly would be in great demand if airplane production increased several times over its present level. Backlogs on Ohio electric furnaces already are very large.

War Equipment Demand To Expand Detroit Plants

Detroit

• • • **Recent news of** increased military demand for equipment of many kinds is expected to bring many blue prints to fruition in the Detroit area and elsewhere. Bids were taken at noon Friday for 420 tons of strucutral steel to be used in a new General Motors truck plant. Significantly, truck plant officials were reported to be in the South observing the war games in which mobile equipment plays a leading role.

Pratt & Whitney at East Hartford, Conn., is taking bids for 1500 tons of structural steel on a building project of long standing revived just a few days ago. For some time it has been known that Glenn L. Martin, Baltimore, has had under consideration a building which will require 2500 tons of steel and Curtiss Wright Corp. at Buffalo has planned since the first of the year to add 1,000,000 sq. ft. to its plant. This would involve 7000 to 8000 tons of steel.

Extra Billion for Defense of U. S.

Washington

• • • **Breakdown of** the projected $1,000,000,000 defense program appeared this week to shape up like this:

$264,000,000—for mechanizing and equipping a contemplated army of 1,000,000 men.

$76,000,000 — for aiding armament plants to speed up production.

$80,000,000—for constructing new type B-17 bombers.

$106,000,000—for necessary training and equipping of 7000 pilots.

$7,000,000—for additional orders to educate industry in the production of special defense items.

$74,000,000—for a wide range of essential items, including motor vehicles, for the regular Army and National Guard forces.

$250,000,000—for 100 or more new naval planes, pushing the entire ship-

the Frankford arsenal, and heard addresses involving the war effects on industry but found time to consider various other industrial problems. A news story of the convention appeared on page 79-D, THE IRON AGE, May 16. • •

building program, and recommissioning 35 World War destroyers.

$64,000,000—for anti-aircraft equipment.

$28,000,000—for modernizing present fighting aircraft.

$4,000,000—for seacoast defenses.

$6,000,000—for replacements and improvements of defenses at the Panama Canal.

$8,000,000—for Army air base construction at Anchorage, Alaska.

$15,000,000—for enlisting and training 15,000 new troops.

$200,000,000—for the disposal of the President for purchase of necessary items overlooked in the other appropriations but which may be necessary without asking Congress specifically for additional amounts. Half of the sum would be available as contract authorizations for increasing production of planes, anti-aircraft guns and training additional personnel in the use of these weapons.

What this program means to the heavy goods industries is best gaged by reference to orders placed during the past few years when defense purchases have been running about $2,000,000,000 a year.

At this rate of expenditure total contracts awarded by the Government (which of course exclude the heavy private orders resulting from the armament program) for the six-month period ended December, 1939, included $21,418,000 for plain steel and armor plate; $6,445,000 for machine tools; $334,354 for tools, jigs, dies and gages; $3,693,000 for forgings and castings; $114,405,000 for aircraft engines and parts; and $12,059,000 for guns, bombs and small arms.

• • • **Key figures** in industry, Government and labor this week put their shoulders to the wheels of President Roosevelt's new billion dollar defense proposal although many queries remained unanswered, including the question of how the program is to be financed.

Machine tools and aircraft production facilities were in the limelight with Congressional circles expressing concern over what some called an expected bottleneck condition in machine tool production. Conferences growing out of the projected program were in continuous session. These were the developments:

1. **President Roosevelt** revealed the Administration is considering financing of necessary plant expansion through RFC loans. Although Mr. Roosevelt expressed the hope that manufacturers would put up as much money as possible for the purpose, Federal Loan Administrator Jesse Jones said after a White House Conference that there will be no demand for loans which the RFC cannot meet. Other plans in this connection were being discussed, including one which would provide for Government ownership of plants, privately operated.

2. In the construction of new aircraft plants, the White House brought pressure to bear on manufacturers to locate new facilities in the Middle West, away from seaboard locations vulnerable to air attacks. Estimates were that 30 new plants will be needed for turning out planes, engines, equipment and accessories. A "typical plant," developed by use of $63,000 of PWA funds, is planned on a basis of 100 planes per month capacity. This has been taken as a standard unit by the Government for the study of plant capacities.

• • • **Despite organized** labor's warning against "halting" social legislation, the Administration is pushing plans to relax labor laws in its move to speed up the national defense program. It is the view here, however, that the Government will not attempt to put through any legislation that will arouse any formidable labor opposition. Rather, it is suspected that any protests from labor will be of a more or less formal character, not to be taken too seriously, and that in the name of a "national emergency" it will accept the Administration policy.

Meanwhile, both William Green, president, American Federation of Labor, and John L. Lewis, chairman, Congress of Industrial Organization, have asked a voice for labor in the defense program.

The concern of the Government over subversive activities was indicated in a letter sent by the War and Navy Departments and the Maritime Commission to the Senate Committee on Education and Labor protesting against the pending La Follette bill which is designed to eliminate so-called "oppressive practices" against labor.

Meanwhile Chairman Dies of the special House Committee on un-American Activities has demanded legislation to stem the threat of an American fifth column movement. He said that his committee was ready to introduce legislation to safeguard the country's international security but contended that the most pressing need was the enforcement of the existing law.

Canadian Plants Taxed By British War Demand

Toronto

Canada's industrial activities are marching forward at a rapid pace in an effort to keep up with the growing demand for materials and products necessary to the carrying on of the war. Demand for steel and steel products to provide munitions, guns, ships, motor vehicles and airplanes, is taxing Canadian production capacity and both the primary and secondary plants are spending millions of dollars to meet this greatly increasing business on war account, while at the same time the ordinary consumption requirements also are making heavy demands on mills for various lines of steel.

The change in war operations has been reflected in more concern in war materials, resulting in sharp increase in orders being placed in Canada. During the past week the Department of Munitions and Supply, Ottawa, placed 937 contracts at an average daily rate of 156 with total value of $15,400,000, and negotiations are underway toward the placing of future orders on a much broader scale.

The automotive industry is swinging more extensively into the production of war vehicles and it is understood that tanks as well as trucks are to be turned out in a large way in this country. Among the larger contracts placed for mechanical transport equipment by the Department of Munitions and Supply during the week were, $322,612 to Ford Motor Co. of Canada, Ltd., Windsor, Ont.; $6,880 to General Motors of Canada, Ltd., Oshawa, Ont.; $70,736 to Canadian Top & Body Corp., Ltd., Tilbury, Ont.; $32,085 to Frost & Wood Co., Ltd., Smith Falls, Ont.; $32,085 to Brantford Coach & Body Co., Ltd., Brantford, Ont.; $24,955 to Cockshutt Plough Co., Ltd., Brantford, Ont.

In connection with its rolling stock purchasing program involving upward of $10,000,000 for the current year, the Canadian Pacific Railway Co., Montreal, is asking tenders on construction of 25 passenger coaches.

In the iron and steel markets new business is showing improvement largely due to the increased placing of war contracts.

Closed Shop is Gaining, SWOC Delegates Told

Chicago

• • • **More than 80 per cent** of contracts signed by the Steel Workers Organizing Committee with steel manufacturing, processing and fabricating companies since Jan. 1, 1940, either recognized the SWOC as sole bargaining agent or established the union shop, steel union officials said at the annual convention held last week in Chicago. Approximately 90 contracts have been signed since Jan. 1, Philip Murray, SWOC chairman, said.

Eight hundred union delegates at the convention approved merging of the SWOC and the Amalgamated Association of Iron, Steel and Tin Plate Workers, and adopted more than 40 resolutions. Some of these would guarantee collective bargaining in Government contracts, increase unemployment compensation, eliminate all sales, wage and consumers taxes, lift taxes upon large incomes, and support a two-year public works program. Other resolutions condemned anti-alien and criminal syndicalism bills and asked for elimination of war profiteering.

The SWOC delegates urged the raising of minimum pay standards under the Fair Labor Standards Act, called for large appropriations for enforcement machinery, and condemned the act's present enforcement.

"You don't know what you can get from American industry if you will only organize," Mr. Murray told the convention.

Requests by some delegates for a financial audit of the SWOC's income and spending was overruled, David J. MacDonald, SWOC secretary-treasurer, declaring that a detailed financial statement, if made public, would be used by enemies of the union to destroy it.

The SWOC maintains a total of 65 offices which are directed by the head office at Pittsburgh, Mr. MacDonald said. Field representatives are paid $208 monthly and directors are paid $260 monthly. During the steel industry's low operating period in 1938 directors and field representatives were paid for from 14 to 19 days a month, although they worked the full period. Of a total of $1,561,000 borrowed by the SWOC from the United Mine Workers Union, $80,000 has been repaid, MacDonald said.

The convention recommended that workers displaced by technological changes in industry should be notified six months in advance and should be given opportunities to learn other types of work through vocational guidance and training. Displaced workmen who cannot find other employment should be paid a dismissal wage of 10 per cent of their earnings for a 10-year period, with a minimum payment of $500 for those with less than 10 years' service.

THIS is R. E. Zimmerman, research vice-president, U. S. Steel Corp., showing company stockholders a wrench which has bent under pressure but which has not broken because it is Austempered.

"Quarter Century" Men Hailed at Sheet & Tube

Youngstown

• • • **Time went into** reverse here last Saturday night and flashed back as far as 57 years as 1100 older workers from all departments of Youngstown Sheet & Tube Co. celebrated their long-time association.

Executives and employees whose loyalty and service have contributed to development of their company and the Youngstown district, sat side by side in Stambaugh Auditorium, where the serious part of the program was brief but impressive, preceded by entertainment and followed by an hour of good fellowship and fraternizing.

To the few outsiders attending, the assemblage of those with 25 or more years of service was an emphatic answer to complaints that experience is no longer valued by industry. Exemplifying the American system of advancement from the ranks, Frank Purnell, who rose from office boy to president, sat with the group of 35-year employees. Numerous other executives were in the 1100.

The memory of the late James A. Campbell and the other venturesome organizers of the company was honored. A large colored camera portrait of him was unveiled, made by Walter Bartz, company photographer and a 35-year man who took many pictures of Mr. Campbell. Numerous others in the audience knew "Jim" Campbell back in 1900, 1901 and 1902 when Sheet & Tube was getting under way. These persons achieved their entire service record as Sheet & Tube workers. Around 85 of the veterans, those with the longest records, were with predecessors of Sheet & Tube. Charles Goers and William Hinrichs occupied the top classifications alone, the former in the 55-year group and the latter in the 50-year group. Goers is a policeman at Brier Hill, which was absorbed by Sheet & Tube. He started in 1883. Hinrichs is a gateman at the Campbell works.

The 1100, including four women telephone operators, were given gold service pins after brief congratulatory messages by President Purnell, William B. Gillies, vice-president in charge of operations, J. L. Mauthe, general superintendent, and W. C.

Reilly, former operating vice-president.

Mr. Purnell praised the loyalty of the group and asserted the badges were more than mere service insignia, being a constant reminder of leadership and the necessity of setting good examples for newer employees.

Mr. Gillies paid tribute to the men for their willingness to meet emergencies over the years. Mr. Mauthe asserted gray heads are a necessary balance wheel in every organization.

Pictured above are nine veteran employees among the 1100 Youngstown Sheet & Tube Co. workmen who received gold service emblems. They are, left to right, W. B. Gillies, vice-president in charge of operations; J. L. Mauthe, general superintendent, Youngstown district; Frank Purnell, president; John Forestal, Ray Zeck, William Scott, Horace Howell, Albert Kinson and Robert Evans.

Prior to the presentation of badges, the Sheet & Tube male chorus under direction of W. Gwynne Jenkins sang, an organ prelude was given by S. Sargis Badal, Jr., Miss Camella Small, chief telephone operator, sang, and the Sheet & Tube orchestra played.

Total service of the 1100 is approximately 32,000 years, an average of around 29 years per person. Based on normal employment of 15,000 men in the Youngstown district, this means that one out of every 14 workers has been with the company an average of 29 years. R. M. Welch, assistant to the president, is among the oldest workers, having been with the company 38 years.

Steel Co. of Canada Mill Placed with Mesta Machine

Pittsburgh

• • • **The 4-high plate mill,** announced recently as part of Steel Co. of Canada's plant expansion project, has been placed with Mesta Machine Co. here. The reversing plate mill, 38 in. and 52 in. x 110 in., will start operations early in 1941, according to Ross H. McMaster, president of the Canadian company.

200 Aircraft Industry Men at Defense Meeting

Washington

• • • **More than 200** representatives of the aircraft industry on Monday went into their first huddle with administration officials on the new defense program. Several expressed dissatisfaction that Government spokesmen offered "no concrete proposals" aimed at helping them reach a 50,000-plane goal. Treasury Secretary Morgenthau, charged with collecting conference information for President Roosevelt, described the meeting as highly satisfactory.

Mr. Morgenthau said that the meeting, attended by key War and Navy and other Government officials, provided a friendly interchange of views; that so far as he knew there was no dissatisfaction over policy matters; that the Government merely asked industry members for their cooperation and, in return, the industry was being given a chance to demonstrate what it could do. He denied that there was any implied threat to go in for Government ownership.

"This does not mean that we're suspending all social legislation and all tax laws," Mr. Morgenthau asserted. "They didn't ask us to and I'm glad they didn't because we're not going to let down those barriers."

Mr. Morgenthau said members of the industry with whom he talked did not express apprehension over shortage of capital or skilled labor. He said that the question of additional floor space was not brought up.

Steel Wage Order Effective May 24

Washington

• • • **Secretary of Labor** Frances Perkins, anticipating the effective date of the Walsh-Healey steel wage order on Friday this week, has requested Government purchasing agents to defer asing for steel bids.

The Secretary's action was explained in a circular letter, issued to all Government departments by the Procurement Division. It said: "The 25 days (since the court order) will expire with May 24 and in anticipation that the wage determination will be operative as to contracts for which bids have been solicited after that date, the Department of Labor requests that offices defer so far as possible, the issuance of invitations for iron and steel commodities covered by the determination until it is operative."

Court To Review Part Of NLRB Order To Republic

Washington

• • • **The Supreme Court** has agreed to review a National Labor Relations Board case against Republic Steel Corp. in so far as a board order required the company to reimburse work relief projects for wages they paid to SWOC employees who went on strike in 1937.

Republic recently petitioned the court to review the case. Its action was based on a decision of April 29 by the Second Circuit Court of Appeals which held that the board has no authority to require an employer to reimburse work relief projects for wages they paid to strikers. This opinion, it was pointed out, was "squarely in conflict" with the prior decision of the Court of Appeals of the Third Circuit which upheld the board order in the Republic case.

Meanwhile, without awaiting the Supreme Court action on the petition, the board proceeded to act as a collection agency to recover back pay from Republic for the strikers. Its Division of Economic Research boosted to 10,000 an estimate of the number of workers' claims for reinstatement and back pay, based on an "early tabulation." Heading the Division of Economic Reseach is David J. Saposs.

Mapes Davidson, former board trial examiner, in recent testimony before the Smith Special House Committee investigating the board, declared that Mr. Saposs was "trying to sabotage every American principle of justice and fair play."

During the first 12 days 3343 workers filed sworn affidavits at the subregional offices opened for the purpose by the division in four Ohio cities, a board statement said. The number of claims, it was added, are expected to reach a peak by July 1, 1940.

Bids Sought May 31 on Four Light Destroyers

Washington

• • • **The Navy Department** has called for bids May 31 on the construction of four light destroyers. To require 2400 tons of steel, the ships are among the final ones to be constructed under the Navy's commitment for the 1941 building program.

Follansbee Gives Details Of Modernization Program

Pittsburgh

• • • **New equipment to** be installed by Follansbee Steel Corp. at Follansbee, W. Va., in its modernization program includes two 34-in. wide, single stand, 4-high reversing cold reducing mills and one 43-in., single stand, 4-high temper mill, along with auxiliary shearing, cleaning, pickling and annealing equipment. These mills, together with the present 38-in. wide cold reduction mill installed at the Follansbee plant in 1933, and such other of the company's present rolling equipment as will be continued in use, will give a total capacity of 145,200 tons a year of flat rolled products. These include sheets, tin plate, terne plate, roofing terne, black plate and electrical sheets.

Steel for electrical sheets, as heretofore, will be made in the Toronto, Ohio, plant.

Indians Had Frontiers, Look At Them Now—C. D. Dallas

• • • **At Hot Springs, Va.,** last week, members of the Copper and Brass Products Association heard C. Donald Dallas, president, Revere Copper & Brass, Inc., urge that industry fight "the present trend toward communism and national socialism." Said Mr. Dallas:

"We are gravely told by some groups that our physical frontiers gave opportunity and security to our people until a few years ago, but that now our physical frontiers have been reached, and that therefore we must change our form of government and have a regimented economy. Well, the American Indians had physical frontiers as vast as any people that ever lived, and they had about the lowest standard of living that the human race has ever descended to."

Polishing Test Laboratory Opened by Continental Roll

• • • **The industrial** equipment division of the Continental Roll & Steel Foundry Co., East Chicago, Ind., has established a testing laboratory to make polishing and buffing time and method studies in connection with its semi-automatic polishing and buffing machine. The company is inviting manufacturers and platers to send in samples for test. Recommendations already issued from the laboratory have resulted in savings in work chucking costs and more effective use of abrasives.

Toledo Foremen's Club Elects Ryan President

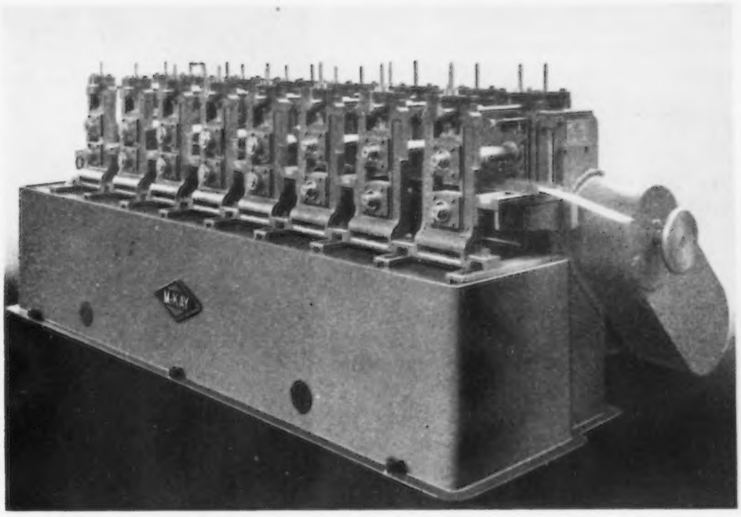
Toledo

• • • **Fay Ryan,** Electric Auto-Lite Co., has been named president of the Foremen's Club of Toledo. At the annual meeting more than 1000 heard W. J. Cameron, Ford Motor Co., speak on "Turns in the Road." John D. Biggers, president, Libbey-Owens-Ford Glass Co., introduced Mr. Cameron.

Tool Company at Toledo To Build $500,000 Plant

• • • **City Auto Stamping Co.,** of Toledo, Ohio, manufacturer of dies, tools and stampings for the automobile industry, has announced purchase of a 10-acre site for erection of a $500,000 die plant.

McKAY *Roll Forming Machines*



1. Micrometric recording of roll pressures which insures correct pressure adjustment of the top roll—a very important factor in successful rolling.

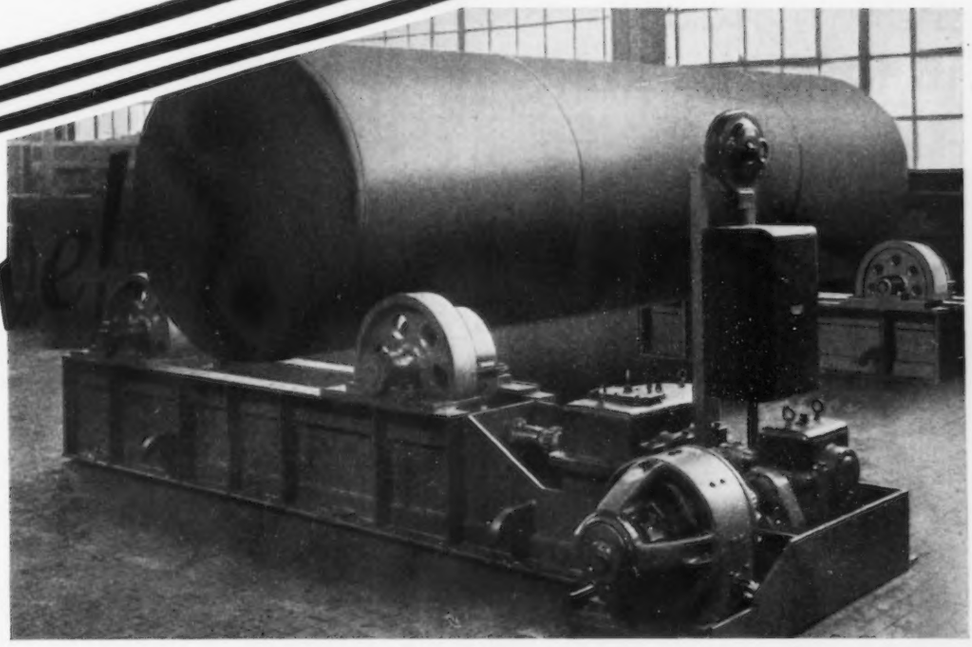
2. Removable guide decks which are adjustable with reference to the rolls and serve as a permanent means of correct positioning for subsequent change-overs.

3. Adjustable straightener unit which is removable with all settings intact.

McKAY COLD ROLL FORMING MACHINES have been designed to include the following features which permit change-over of rolls from one section to another in from one to two hours and, also, make operation of the machine practically fool proof:

Sa

TIME *and* MONEY



A new development by THE McKAY MACHINE COMPANY to simplify and speed up the welding or riveting of large cylindrical tanks.

Power Turning Roll Unit is capable of turning a tank weighing 30,000 lbs. when one end of tank is supported on idler rolls. This unit has a variable speed of from 3 in. to 30 in. per minute.

THE McKAY MACHINE CO

ENGINEERS AND MANUFACTURERS OF SHEET, TIN AND STRIP MILL EQUIPMENT

YOUNGSTOWN, OHIO

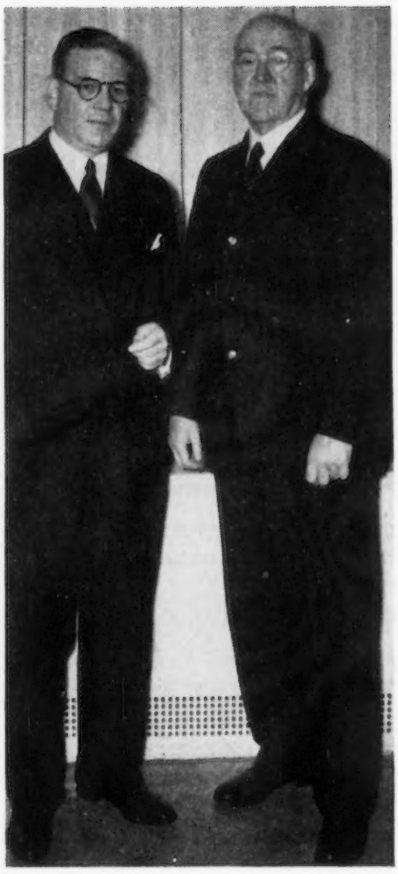
Warner & Swasey Opens Bureau To Train Turret Lathe Operators

• • • **An educational program** designed to aid in training of apprentices and help experienced operators of the country's 55,000 turret lathes increase their skill has been announced by the Warner & Swasey Co., Cleveland machine tool builders. Organization of a "Turret Lathe Operators Service Bureau" established to carry out the program was explained by Clifford S. Stilwell, executive vice-president of the company, before a group of the country's leading personnel executives at the Biltmore Hotel, New York, on May 16.

Designed to help the machine tool using industries solve production problems created by the lack of skilled mechanics, the new service bureau will get under way immediately with a three-point program.

The bureau will send lecturers into manufacturing plants all over the country with sound slide films, charts and models, to show operators the modern and improved operating techniques of utilizing turret lathes and tooling equipment. A 240-page text book published by the bureau will give operators an opportunity to improve their technique through home study. A monthly publication called *Blue Chips* will permit exchange ideas and keep operators posted on latest developments in their field.

"A paradox of the times is that whenever the metal-working industries reach a high level of operations, they can't find enough properly trained skilled mechanics, although millions of men are looking for work," Mr. Stilwell said. Also, "it is necessary to give operators all available information on newer methods to obtain full advantage of modern machine tools."



Clifford S. Stilwell, executive vice-president, Warner & Swasey Co.; and Dr. L. P. Alford, head of department of industrial engineering, New York University.

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Westinghouse Will Spend $500,000 at Mansfield, Ohio

• • • **Plans for a** half-million dollar expansion program at the Mansfield, Ohio, plant of the Westinghouse Electric & Mfg. Co. are announced by L. E. Osborne, manager of manufacturing and engineering of the Westinghouse merchandising division. Work will start within a month on the expansion program, which will increase the Mansfield plant's capacity in production of household refrigerators by one-third, Mr. Osborne said. Bids will be let by the general contractor in two or three weeks. The new building has been designed by Albert Kahn, Inc., Detroit.

New Plant Will Be Built By Monsanto Chemical

• • • **Construction of** a new plant in Springfield, Mass., for manufacture of Resinox phenolic plastic molding materials has been announced by John C. Brooks, vice-president, Monsanto Chemical Co. and general manager of the Monsanto plastics division. Work will be begun as soon as contracts can be let.

Vinson Bill Would Ease Law for Navy Shipbuilding

Washington

• • • **The bill** to remove deterrents to the Navy's shipbuilding program, introduced in the House on Monday by Chairman Carl Vinson, of the House Naval Affairs Committee, would:

1. Empower the President to suspend the Walsh-Healey Public Contracts Act with its present 40-hr. maximum work week provision in so far as it affects naval contracts.

2. Exempt naval contracts up to $25,000 from the 10 per cent profits limitation provisions of the Vinson-Trammel Act.

3. Relax civil service hiring requirements for Navy Yard workers, giving personnel officers a wider selection of American workmen from which to meet expanded requirements of the proposed new $250,000,000 program.

Consolidated Steel Low Bidder on Four Ships

Washington

• • • **The Consolidated Steel Corp.,** Los Angeles, was apparently the lowest bidder on a fixed price basis and the Bath Iron Works, Bath, Me., the lowest bidder on an adjusted price basis on four ships for export lines, tenders for which were opened on Tuesday by the Maritime Commission. The four ships will require about 16,560 tons of steel.

Supreme Court Upholds Bituminous Coal Act

Washington

• • • **In an eight-to-one** decision handed down May 20 the Supreme Court held the National Bituminous Coal Act to be constitutional. Justice McReynolds dissented. The act authorizes the commission to fix minimum prices, a provision that is not yet in effect.

Jeannette Rifles Ready For Parachute Troops

Pittsburgh

• • • **Sharpshooters belonging** to a gun club at Jeannette, Pa., near here, have organized the first civilian parashootist legion in the United States to help defend the Pittsburgh industrial district from possible attack. F. B. Brust and W. H. Landis, newspaper editor, head the organization.

G-E Reduces Mazda Lamp Prices By 17%

Cleveland

• • • **General Electric Co.** announces a sweeping price reduction, averaging 17 per cent, in list values of nearly 100 types and sizes of Mazda lamps. Most of the lamps affected are general service types for use in factories and elsewhere.

Steel & Wire to Reline Donora Works Furnace

Pittsburgh

• • • **No. 1 stack,** idle since October, 1930, at the Donora steel works of American Steel & Wire Co., will be relined and a new primary gas washer will be installed, according to a company announcement. Three stoves will be relined.

Government Orders for Week Total $1,628,024

Washington

• • • **Government contracts** for iron and steel products, as reported for the week ended May 11 by the Labor Department's Public Contracts Division, totaled $498,735. For the same period, contracts were reported totaling $75,350 for non-ferrous metals and alloys; and $1,053,939 for machinery. Details follow:

Iron and Steel Products

Bourlier Sheet Metal Works, Inc., Louisville, galvanized iron hoods, $10,764; A. Finkl & Sons Co., Chicago, breech ring forgings, $23,400; Columbia Steel Co., San Francisco, reinforcement bars, $100,100; Philips & Davies, Inc., Kenton, Ohio, slide gates, $22,700; Indiana Steel & Wire Co., Muncie, Ind., strand wire, $91,434; Joshua Hendy Iron Works, San Francisco, high-pressure gates, $17,657; American Bridge Co., Pittsburgh, steel towers, $99,794; Pittsburgh Steel Drum Co., Butler, Pa., steel drums, $14,945; Commercial Shearing & Stamping Co., Youngstown, plate linings, $26,400; American Car & Foundry Co., New York City, demolition bombs, $81,167; Osgood Co., Marion, Ohio, steel castings, $10,374.

Non-Ferrous Metals and Alloys

Phelps Dodge Refining Corp., New York City, electrolytic copper, $22,600; Scovill Mfg. Co., Philadelphia, 5c. blanks, $52,750.

Machinery

Bennett-Rafkin Machine Tool Co., Inc., New York City, planer, $11,175; Cleveland Tractor Co., Cleveland, tractors, $186,540; Ingersoll-Rand Co., Cincinnati, air compressors, $34,744; Orton Crane & Shovel Co., Chicago, crane, $13,860; Producto Machine Co., Bridgeport, Conn., milling machines, $16,250; Ingersoll-Rand Co., New York City, construction machinery, $22,509; Galion Iron Works & Mfg. Co., Galion, Ohio, construction machinery, $18,674; Allis-Chalmers Mfg. Co., Milwaukee, governor turbine, $616,900; U. S. Hoffman Machinery Corp., New York City, laundry machinery, $31,300; American Machine & Metals, Inc., East Moline, Ill., laundry machinery, Ill., $16,233; National Acme Co., Cleveland, spindle machines, $35,272; Caterpillar Tractor Co., Peoria, Ill., tractors, $14,572; Buda Co., Harvey, Ill., gasoline engines, $11,347; Prosperity Co., Inc., Syracuse, N. Y., laundry presses, $24,560.

Producing Steel

(CONCLUDED FROM PAGE 54)

volving forming and drawing requirements).

Whenever physical properties are specified, these should not be less than the established standard ranges for sheets and strip. In light gages the specifying of tensile properties is objectionable unless the testing is carried out on equipment especially adapted to these products. Furthermore, the producer has great difficulty in maintaining uniform rolling conditions in the very light gages which, of course, affects the tensile properties. If it is necessary to meet specified physical properties the sheet producer must carefully select the heats, or parts of heats, or definite portions of ingots, so that he has quite uniform composition in the raw material. In addition, the rolling and finishing temperatures must be maintained in narrow ranges and the cooling of the product carefully controlled.

Specifications calling for both chemical composition and physical properties are so hazardous, due to high rejections involved, that it is customary not to accept any orders specifying both requirements. The reason for this is that the composition must be compatible with a particular rolling practice and with the section produced. To illustrate this, there is shown below an approximation of what can be expected in producing the heavier thicknesses of hot rolled sheets on a typical hot continuous strip mill with normal rolling conditions. The only rolling variable involved is difference in cooling rate due to the thickness and width of the material.

	Tensile Strength, Lb. Per Sq. In.		
Thickness, In.	0.10 Carbon	0.20 Carbon	0.30 Carbon
0.100	53,000	64,000	80,000
0.250	48,000	53,000	62,000

It can be seen from the above that the same carbon content gives different tensile properties, depending upon the cooling rate, which depends on thickness and size of the sheet. Therefore, the same composition cannot be used to obtain identical physical properties in the different thicknesses.

An example of the impracticability of specifying both chemical composition and a physical property was found in a consumer specification calling for 0.16 to 0.23 C and a minimum yield point of 41,000 lb. per sq. in. In keeping within the carbon range the yield point of the sheets was well above the requirement, but the percentage of breakage during forming was high. After months of effort, the consumer was persuaded to waive the carbon requirement, and work only to the physical. This permitted working to a lower carbon range which produced a sheet closer to 41,000 lb. per sq. in. yield point and increased the ductility, to the extent that the amount of breakage was negligible.

The larger tonnages of sheet and strip orders call for the material to produce a definite part involving principally drawing requirements. A large share of these sheets are used by the automobile stamping companies to produce inside and outside parts of automobiles. When sheets are ordered to produce a definite part, the sheet producer assumes the responsibility of furnishing a product to make the part. If the sheet fabricator places a chemical, physical or hardness restriction in his specification, the responsibility for successfully making the part rests with him.

Personals

Change is inevitable in progressive Industry. Change is constant.

● W. V. PETERS and C. B. MCGEHEE have been appointed managers of sales, Truscon Steel Co., Youngstown, in charge of northern and southern areas, respectively. These appointments followed the resignation of GROVER J. MEYER, formerly general manager of sales.

Mr. Peters formerly was assistant general manager of sales, and before that was successively district sales manager in Cleveland and manager of sales, steel window division in Youngstown.

Mr. McGehee, until his appointment as manager of sales, southern area, was manager of sales of the highway products division in Youngstown and district sales manager in Atlanta, Ga., and Dallas, Tex.

● WARREN W. SCHERER has been appointed superintendent industrial relations, Carnegie-Illinois Steel Corp.'s Irvin works, and ARTHUR M. KRIEGER has been made superintendent of maintenance. Other employees promoted and their new titles are: JOHN A. DRGON, assistant superintendent of maintenance; THOMAS W. HUNTER, assistant division superintendent, flat products finishing; CHARLES A. LARKIN, general foreman, cold reductions; WILLIAM SPRINGFIELD, lubrication foreman, maintenance, and JOHN STURDY, maintenance foreman, flat products finishing.

● DAVID L. MEKEEL, who has been associated with engineering and development for many years in the steel industry, has retired from active duty with Jones & Laughlin Steel Corp., to enter the field of general steel mill consultant. He will be located in Pittsburgh, with temporary offices at his residence in Coraopolis Heights, Coraopolis, Pa.

Mr. Mekeel's first connection with the steel industry was at the Cambria Iron Co., in Johnstown, predecessor of the Cambria plant of Bethlehem Steel Co., in the development of the rail mill. This was followed by a couple of years with the Johnson Co., predecessor of National Tube Co. plant at Lorain, Ohio, after which he went with the American Steel & Wire Co. at Newburg, as works engineer. He later joined the Jones & Laughlin organization as chief engineer, South Side works. Successively, he was made chief engineer and consulting engineer Jones & Laughlin Steel Corp., participating in engineering problems in connection with development of coal, ore, limestone, and water and rail transportation properties, as well as works development covering a diversified line of finished products. While with Jones & Laughlin he took an active part in the development of large tilting open hearth furnaces built for the Talbot process of steel making; the development of the large blast furnace; the installation of welded and seamless tube mill; the development of cold reducing processes for manufacture of tin plate; as well as the construction and utilization of other steel mill equipment.

● WILFRED SYKES, assistant to the president of Inland Steel Co. and chairman of the board of Wilson & Bennett Mfg. Co., Chicago, was elected to the board of trustees of Armour Institute of Technology, last week. Mr. Sykes was born in New Zealand and is known throughout the United States as a pioneer in the development of electrical equipment for steel mills. He joined the staff of the Inland Steel Co. in 1923 after serving as engineer for Westinghouse Electric & Mfg. Co., and as executive engineer with the Steel & Tube Co. of America.

● JAMES F. MCNAMARA, manager of monel and rolled nickel sales for the International Nickel Co., New York, has been elected a director of the Harvil Aircraft Die Casting Corp.,

W. V. PETERS, manager of sales in charge of the northern area for Truscon Steel Co.

C. B. McGEHEE, who holds a similar post for the southern area for Truscon.

WARREN W. SCHERER, superintendent industrial relations of the Irvin works of Carnegie-Illinois Steel Corp.

Los Angeles. With 30 years' association with the International Nickel Co., he has had a wide experience in the promotion of metals and alloys throughout industry.

●C. B. BOYNE has been made manager of stainless sales, Allegheny Ludlum Steel Corp., Pittsburgh. Mr. Boyne entered the employ of Ludlum Steel Co. in 1913, in a clerical capacity. After capably filling a number of clerical positions in the sales department, in 1919 he was made manager of order and billing department. In 1923 he became supervisor of warehouse stock control and four years later was promoted to assistant manager of sales. In 1930 he was transferred to the Associated Alloy Steel Co., Cleveland, as assistant sales manager. In 1934 he returned to Ludlum Steel Co., as assistant to the president, and in 1936 he was appointed manager of stainless sales of the old Ludlum Steel Co. After the merger with Allegheny, Mr. Boyne was transferred to Pittsburgh, as manager of stainless bar and wire sales.

● CHARLES B. BOHN has become chairman of the board of directors of the Bohn Aluminum & Brass Corp. and P. A. MARKEY, former vice-president and treasurer, has been made president. S. D. DEN UYL, secretary, also will bear the duties of treasurer. EMERSON FRANZ has been elected vice-president in charge of sales and HENRY LEVITT, vice-president in charge of the Michigan Smelting & Refining Division. F. M. TAYLOR has been made assistant secretary-treasurer.

JAMES F. McNAMARA, director of Harvil Aircraft Die Casting Corp.

●W. B. HURLEY has been appointed assistant chief of the Ordnance district to serve the Ordnance Department, U. S. Army, in the Detroit area. In the recent announcement of his appointment in these columns, an error in type setting failed to make this clear. Alex Dow is the chief officer.

●CHARLES R. MORRISON, vice-president of the International Harvester Co. in charge of domestic and Canadian sales, has retired after 42 years of service with the company and one of its predecessors.

J. L. MCCAFFREY, whose first job was as a warehouse clerk in the company's sales branch house at Cincinnati, has been elected vice-president in charge of sales to succeed Mr. Morrison.

Mr. McCaffrey's entire business career has been spent in the sales department of the Harvester company. He has held in succession almost every job in the department, advancing from warehouse clerk to branch advertising man, full-time motor truck salesman, assistant branch manager at Cincinnati, followed by a later advancement that brought him to the Chicago offices as assistant manager of the central sales district. For the past several years he has been director of domestic and Canadian sales, and it is from that position that he has been advanced to the vice-presidency.

Mr. Morrison began his business career with the old Deering Harvester Co. in 1898 as bookkeeper, and held a succession of important positions in the company's accounting and sales departments. He was elected vice-president in charge of sales in 1935.

●C. L. BARRETT, formerly general sales manager of the Pomona Pump Co., Pomona, Cal., has been elected vice-president in charge of sales. W. D. TURNBULL has been appointed general sales manager in charge of the newly opened New York office of the company at 120 Broadway.

Prior to joining the Pomona organi-

ARTHUR M. KRIEGER, new superintendent of maintenance at Irvin works.

DAVID L. MEKEEL, who has retired from active duty with Jones & Laughlin to become general steel mill consultant.

WILFRED SYKES, new member of board of trustees of Armour Institute of Technology.

zation, Mr. Turnbull was for 17 years associated with the Westinghouse Electric & Mfg. Co., for a number of years in charge of sales and engineering to the mining and petroleum industries and later as manager of machinery electrification sales. Associated with Mr. Turnbull in the New York office will be SVEND A. CANARIIS, G. H. LAMBERT, Eastern district manager, and GEORGE H. SHETLIN, export sales.

● WEST WETSEL, of the Baush Machine Tool Co., Springfield, Mass., who recently sailed for Italy, is in France and will visit England on a business trip.

● GUY J. BATES, formerly with General Motors Institute, Flint, Mich., is now with Inland Mfg. division of General Motors Corp., Dayton, Ohio.

● R. G. MCELWEE, Vanadium Corp. of America, has been placed in charge of a newly created foundry unit in Detroit. Formerly connected with the Ecorse Foundry Co., Ecorse, Mich., Mr. McElwee has been a consultant with the Vanadium Corp. since 1936.

● F. RAY FLEIG, Smith Facing & Supply Co., has been elected vice-president of the Northeastern Ohio chapter of American Foundrymen's Association, Cleveland. FRANK J. DOST, Sterling Foundry Co., Wellington, Ohio, is vice-president; B. F. LAMBERT, Diamond Alkali Co., is secretary, and R. F. LINCOLN, Osborn Mfg. Co., has been re-elected treasurer. Mr. Flieg succeeds ERNEST F. HESS, Ohio Injector Co., Wadsworth, Ohio.

● D. W. HADSELL, general foreman, of the wire, rod and conduit department of Youngstown Sheet & Tube Co., has been installed as chairman of the Mahoning Valley Chapter of American Society for Metals. E. E. MCGINLEY, Carnegie-Illinois metallurgist, is vice-chairman, and ANTHONY ROSS, metallurgical department of Youngstown Sheet & Tube, is secretary-treasurer.

● H. S. STROUSE, treasurer of the Harnischfeger Corp., Milwaukee, has been elected chairman of the Electric Hoist Manufacturers Association, New York, succeeding W. W. PEATTIE, of the Northern Engineering Works. F. F. SEAMAN, general manager of the hoist and crane division at Springfield, Ohio, of Robbins & Myers, Inc., has been elected vice-chairman.

● EDWARD J. SKINNER, who has been identified with the Renown Stove Co., Owosso, Mich., since 1909, has been made factory superintendent, succeeding the late Claude J. Sperry.

● ALLAN BROWN, advertising manager and director of public relations of the Bakelite Corp., New York, received an award from the Technical Publicity Association for "Distinguished Services in the Cause of Technical Advertising" at a conference in New York last week celebrating the 35th anniversary of the association.

● CHARLES N. FITTS, a director of the American Institute of Steel Construction, New York, from the time of its organization to last year, has been elected an honorary member of the institute.

● STEWART E. LAUER, president of the York Ice Machinery Corp., York, Pa., has been elected president of the Air Conditioning Manufacturers' Association. Stuart M. Crocker, manager of the air conditioning department of General Electric Co., has been elected vice-president, and P. A. McKittrick, general manager of the Parks-Cramer Co., has been made treasurer.

● WILLIAM S. SHIPLEY, chairman of the board of the York company, heads the refrigerating industry as president of the Refrigerating Machinery Association.

● L. R. HOFF, vice-president in charge of sales of Johns-Manville Corp., New York, was the guest of honor last week at a luncheon given by the board of directors on the completion of his 40th year of service with the company.

● O. P. ROBINSON, heretofore identified with the Chicago office of Cutler-Hammer, Inc., Milwaukee, has been appointed to the sales engineering staff of the company's Pittsburgh office.

● HENRY VOGT, vice-president of Cutler-Hammer, Inc., and WALTER DUNLAP, president of Klau-Van Pietersom-Dunlap Associates, Inc., advertising agency, have been elected to the board of directors of Globe-Union, Inc., Milwaukee. They succeed the late Clifford Stevens, former vice-president of Cutler-Hammer, and the late Howard Kroehl, a Chicago accountant executive.

Obituary

● EDWARD A. WETZEL, assistant chief engineer of the Briggs Mfg. Co., Detroit, died May 16 at his home in Grosse Pointe Park, Mich. Mr. Wetzel was born in Royal Oak, Mich., 43 years ago, and had been an employee of Briggs 11 years. He was assistant chief engineer of the Stutz Motor Car Co., Indianapolis, before he joined the Briggs organization. During the World War he served in the Navy.

● HARRY CHALLINGSWORTH, superintendent of the iron foundry, McIntosh Hemphill Co., Pittsburgh, died suddenly at his home in Pittsburgh on May 12. Mr. Challingsworth, a native of England, had been associated with McIntosh Hemphill for the past 37 years. He first worked at the company's Fort Pitt foundry and latterly at the company's Garrison works, Southside, Pittsburgh.

● JOHN C. COLEMAN, Detroit manufacturer, died May 12. Born in Chatsworth, Ont., Mr. Coleman went to Michigan as a young man and sold carriages for the Prouty & Glass Co. at Wayne, Mich. He later became superintendent of the Albion Carriage Works and in 1905 became one of the pioneer manufacturers of automobile parts under the firm name J. C. Coleman Co. He also founded the Wayne Steering Wheel & Bow Co. He was 85 years old at the time of his death.

● FREDERICK BRUST, superintendent of construction for the United States Lighthouse Service for many years, died May 14 in a hospital at Detroit at the age of 79.

● AUGUST C. THODE, assistant superintendent of the pattern shop at the Allis-Chalmers Mfg. Co., Milwaukee, died May 14 in a Milwaukee hospital at the age of 62 years. He was born in the town of Muskego, Wis., and had lived in Milwaukee and Wauwatosa, Wis., all his life. He had worked for Allis-Chalmers for 39 years.

● FRANK BAYLEY, aged 76 years, who with his father, the late William Bayley, operated an iron foundry in Milwaukee for many years, died May 14 at the home of a daughter in that city. He was born in Milwaukee and was a member of a pioneer Milwaukee family.

● ARTHUR J. GOETZMANN, aged 60 years, foreman of the test department at the Allen-Bradley Co., Milwaukee, died May 11 in a Milwaukee hospital. He had been ill since September, when he retired after having held his position at Allen-Bradley for 12 years. He was born in Milwaukee and had been employed previously with the old Northwestern Mfg. Co. He was 60 years old.

First Quarter Finished Steel Production

• • • The American Iron and Steel Institute's report (AIS10) for the first quarter of 1940 shows a total production of all steel products of 10,558,957 net tons, of which 1,302,814 net tons was for export and 673,383 net tons was shipped to other members of the industry for conversion into finished products.

In the last quarter of 1939 total steel production was 13,560,069 net tons, with 1,013,768 tons going for export and 1,468,373 tons being sold for further conversion. The first quarter production figures last year were 7,973,259 tons, with 404,523 tons exported and 774,267 for conversion.

Products showing the highest percentages in the first quarter of 1940 were cold reduced tin plate, 76.1 per cent, compared with 107.3 per cent in the preceding quarter; sheets 71.8 per cent, against 95.5 per cent in the fourth quarter last year; plates, 60.5 per cent, against 64.7 per cent in the fourth quarter, and wire, 59.9 per cent, compared with 84.2 in the last quarter.

AMERICAN IRON AND STEEL INSTITUTE
Capacity and Production for Sale of Iron and Steel Products

First Quarter - 1940
PERIOD

		Number of companies	Items	Annual Capacity Net tons	Production for Sale—Net Tons: Current ~~Month~~ Quarter — Total	Current — Per cent of capacity	Current — Shipments: Export	Current — Shipments: To members of the industry for conversion into further finished products	To Date — Total	To Date — Per Cent of capacity	To Date — Shipments: Export	To Date — Shipments: To members of the industry for conversion into further finished products
Steel Products	Ingots, blooms, billets, slabs, sheet bars, etc.	32	1	xxxxxxx	1,073,843	xxx	316,210	364,615		xxx		
	Heavy structural shapes	8	2	5,205,300	536,714	41.5	40,746	-				xxxxxxx
	Steel piling	4	3	328,000	29,178	35.8	3,133	-				xxxxxxx
	Plates—Sheared and Universal	19	4	5,855,450	880,496	60.5	87,843	10,098				
	Skelp	7	5	xxxxxxx	118,204	xxx	20,162	39,548		xxx		
	Rails—Standard (over 60 lbs.)	4	6	3,647,600	490,614	54.1	21,205	-				xxxxxxx
	Light (60 lbs. and under)	6	7	306,800	25,180	33.0	6,985	-				xxxxxxx
	All other (Incl. girder, guard, etc.)	2	8	118,000	10,976	37.4	1,420	-				xxxxxxx
	Splice bar and tie plates	14	9	1,300,200	166,156	51.4	2,755	-				xxxxxxx
	Bars—Merchant	35	10	xxxxxxx	1,045,903	xxx	79,151	86,720		xxx		
	Concrete reinforcing—New billet	14	11	xxxxxxx	226,072	xxx	75,061	-		xxx		xxxxxxx
	Rerolling	18	12	xxxxxxx	27,030	xxx	3,478	-		xxx		xxxxxxx
	Cold finished—Carbon	18	13	xxxxxxx	163,632	xxx	2,477	-		xxx		xxxxxxx
	Alloy—Hot rolled	15	14	xxxxxxx	207,557	xxx	12,924	15,429		xxx		
	Cold finished	14	15	xxxxxxx	23,496	xxx	490	-		xxx		xxxxxxx
	Hoops and baling bands	5	16	xxxxxxx	21,317	xxx	1,196	-		xxx		xxxxxxx
	TOTAL BARS	53	17	12,355,730	1,715,007	55.8	174,777	102,149				
	Tool steel bars (rolled and forged)	15	18	110,220	16,596	60.6	732	-				xxxxxxx
	Pipe and tube—B. W.	13	19	1,665,860	196,154	47.4	21,060	-				xxxxxxx
	L. W.	10	20	1,360,360	73,113	21.6	9,822	-				xxxxxxx
	Electric weld	5	21	731,520	53,719	29.5	6,974	-				xxxxxxx
	Seamless	15	22	3,347,590	455,401	54.7	45,580	-				xxxxxxx
	Conduit	5	23	133,145	15,006	45.3	551	-				xxxxxxx
	Mechanical Tubing	12	24	367,475	52,273	57.2	2,986	-				xxxxxxx
	Wire rods	19	25	xxxxxxx	253,839	xxx	60,407	38,691		xxx		
	Wire—Drawn	37	26	2,255,350	336,122	59.9	40,395	5,057				
	Nails and staples	19	27	1,091,690	133,441	49.2	14,664	-				xxxxxxx
	Barbed and twisted	16	28	438,270	41,712	38.3	6,372	-				xxxxxxx
	Woven wire fence	15	29	772,791	57,518	29.9	612	-				xxxxxxx
	Bale ties	11	30	119,050	11,331	38.3	45	-				xxxxxxx
	All other wire products	6	31	27,030	2,286	34.0	-	-				xxxxxxx
	Fence posts	12	32	145,800	11,429	31.5	230	-				xxxxxxx
	Black plate	12	33	653,295	91,953	56.6	3,941	31,287				
	Tin plate—Hot rolled	9	34	1,201,960	144,319	48.3	51,283	-				xxxxxxx
	Cold reduced	10	35	2,930,860	554,495	76.1	122,503	-				xxxxxxx
	Sheets—Hot rolled	26	36	xxxxxxx	1,334,759	xxx	134,978	40,306		xxx		
	Galvanized	16	37	xxxxxxx	309,137	xxx	45,392	-		xxx		xxxxxxx
	Cold rolled	18	38	xxxxxxx	570,661	xxx	25,875	-		xxx		xxxxxxx
	All other	15	39	xxxxxxx	149,856	xxx	4,679	-		xxx		xxxxxxx
	TOTAL SHEETS	27	40	13,233,770	2,364,413	71.8	210,924	40,306				
	Strip—Hot rolled	24	41	3,524,750	350,929	40.0	19,401	41,632				
	Cold rolled	35	42	1,305,360	177,088	54.6	4,592	-				xxxxxxx
	Wheels (car, rolled steel)	5	43	419,035	58,853	56.5	1,649	-				xxxxxxx
	Axles	5	44	472,280	27,909	23.8	1,350	-				xxxxxxx
	Track spikes	11	45	327,275	29,595	36.4	1,505	-				xxxxxxx
	All other	4	46	9,100	3,095	136.8	-	-				xxxxxxx
	TOTAL STEEL PRODUCTS	133	47	xxxxxxx	10,558,957	xxx	1,302,814	673,383		xxx		
	Estimated total steel finishing capacity based on a yield from ingots of 68.9 %	-	48	53,714,800	xxxxxxx	74.0	xxxxx	xxxxxxx	xxxxxxx		xxxxxxx	xxxxxxx
	Pig iron, ferro manganese and spiegel	27	49	xxxxxxx	1,309,597	xxx	76,958	357,225		xxx		
	Ingot moulds	4	50	xxxxxxx	87,238	xxx	453	-		xxx		xxxxxxx
Iron Products	Bars	9	51	160,600	7,974	20.0	34	704				
	Pipe and tubes	3	52	109,377	8,647	31.8	370	-				xxxxxxx
	All other	2	53	71,180	3,294	18.6	810	1,004				
	TOTAL IRON PRODUCTS (ITEMS 51 to 53)	11	54	276,247	19,915	29.0	1,214	1,708				

Total number of companies included - 153

Total steel products produced for sale, less shipments to members of the industry for conversion into further finished products: Current ~~Month~~ Quarter 9,885,574 N.T.; 74.0 % of Finishing Capacity.
To date ____ N.T.; ____ % of Finishing Capacity.
The above tonnages represent 68.9 % of the ingots produced by companies whose products are included above.

The Iron Age Comparison of Prices

Advances Over Past Week in Heavy Type; Declines in Italics

	May 21, 1940	May 14, 1940	Apr., 23, 1940	May 23, 1939
Flat Rolled Steel:				
(Cents Per Lb.)				
Hot rolled sheets	2.10	2.10	1.90	2.00
Cold rolled sheets	3.05	3.05	2.85	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	1.90	2.00
Cold rolled strip	2.80	2.80	2.60	2.80
Plates	2.10	2.10	2.10	2.10
Tin and Terne Plate:				
(Dollars Per Base Box)				
Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30
Bars and Shapes:				
(Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Wire and Wire Products:				
(Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.45
Rails:				
(Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel:				
(Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Wire Rods and Skelp:				
(Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	1.92
Skelp (grvd.)	1.90	1.90	1.90	1.90

	May 21, 1940	May 14, 1940	Apr., 23, 1940	May 23, 1939
Pig Iron:				
(Per Gross Ton)				
No. 2 fdy., Philadelphia	$24.84	$24.84	$24.84	$22.84
No. 2, Valley furnace	23.00	23.00	23.00	21.00
No. 2, Southern Cin'ti	23.06	23.06	23.06	21.06
No. 2, Birmingham	19.38	19.38	19.38	17.38
No. 2, foundry, Chicago†	23.00	23.00	23.00	21.00
Basic, del'd eastern Pa.	24.34	24.34	24.34	22.34
Basic, Valley furnace	22.50	22.50	22.50	20.50
Malleable, Chicago†	23.00	23.00	23.00	21.00
Malleable, Valley	23.00	23.00	23.00	21.00
L. S. charcoal, Chicago	30.34	30.34	30.34	28.34
Ferromanganese‡	100.00	100.00	100.00	80.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton. ‡For carlots at seaboard.

Scrap:				
(Per Gross Ton)				
Heavy melting steel, P'gh	$18.75	$18.75	$16.25	$14.25
Heavy melting steel, Phila.	17.75	17.25	16.75	15.25
Heavy melting steel, Ch'go	17.25	16.75	15.375	12.75
Carwheels, Chicago	18.75	18.25	17.00	12.50
Carwheels, Philadelphia	20.75	20.75	20.25	16.00
No. 1 cast, Pittsburgh	19.25	18.75	17.75	15.25
No. 1 cast, Philadelphia	20.25	20.25	20.25	16.25
No. 1 cast, Ch'go (net ton)	16.75	16.25	15.75	11.75
Coke, Connellsville:				
(Per Net Ton at Oven)				
Furnace coke, prompt	$4.00	$4.00	$4.00	$3.75
Foundry coke, prompt	5.25	5.25	5.25	4.75
Non-Ferrous Metals:				
(Cents Per Lb. to Large Buyers)				
Copper, Electro., Conn.*	11.50	11.50	11.50	10.00
Copper, Lake, New York	11.50	11.50	11.50	10.00
Tin (Straits), New York	54.00	53.00	47.50	48.70
Zinc, East St. Louis	5.75	5.75	5.75	4.50
Lead, St. Louis	5.00	5.00	5.10	4.60
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	14.00

*Mine producers only.

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 110 to 116 herein. On export business there are frequent variations from the prices shown above. Also, on domestic business there are at times price ranges for various products, and these ranges are shown in detailed price tables herein.

Composite Prices . . .

	FINISHED STEEL	PIG IRON	SCRAP STEEL
May 21, 1940	2.261c. a Lb.	$22.61 a Gross Ton	$17.92 a Gross Ton
One week ago	2.261c. a Lb.	$22.61 a Gross Ton	$17.58 a Gross Ton
One month ago	2.211c. a Lb.	$22.61 a Gross Ton	$16.13 a Gross Ton
One year ago	2.236c. a Lb.	$20.61 a Gross Ton	$14.08 a Gross Ton

	FINISHED STEEL High	FINISHED STEEL Low	PIG IRON High	PIG IRON Low	SCRAP STEEL High	SCRAP STEEL Low
1940	2.261c., Jan. 2	2.211c., Apr. 16			$17.92, May 21	$16.54, Mar. 19
1939	2.286c., Jan. 3	2.236c., May 16	$22.61, Sept. 19	$20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.512c., May 17	2.211c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.512c., Mar. 9	2.249c., Jan. 4	23.25, Mar. 9	20.25, Feb 16	21.92, Mar. 30	12.92, Nov. 10
1936	2.249c., Dec. 28	2.016c., Mar. 10	19.73, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.062c., Oct. 1	2.056c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.118c., Apr. 24	1.945c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.953c., Oct. 3	1.792c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.915c., Sept. 6	1.870c., Mar. 15	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.981c., Jan. 13	1.883c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.192c., Jan. 7	1.962c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.236c., May 28	2.192c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strip. These products represent 85 per cent of the United States output.

Based on average for basic iron at Valley furnace and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Summary of the Week

• Steel production rises to 74 per cent . . . Allied purchases heavy . . . Italy buys 250,000 tons of scrap . . . Obstacles to U.S. defense are shortages of machine tools, skilled workers and capacity for electric furnace steel.

WHILE steel users are not being stampeded, as they were last fall, there has been substantially heavier domestic buying, which with Allied purchases of close to half a million tons and generally good orders from other countries, Italy in particular, will bring total steel sales in May to about double those of April.

Steel ingot production, again rising sharply, is at the highest level since the last week of January, being estimated at 74 per cent for the current week, or four points above last week. Nearly all districts have gained, Pittsburgh being up six points, Chicago three and a half points, Youngstown three, Buffalo 12, St. Louis 12½ and Southern Ohio three, with lesser rises elsewhere. Higher steel production has been accompanied by the blowing in of a number of blast furnaces.

Despite the probability that a steel shortage could easily occur by midsummer if the war continues, German successes have had a restraining effect on a good many buyers, who are not anxious to build up inventories that would be burdensome in the event of an early termination of the war. This note of hesitation is evident in connection with specifications against low-priced commitments for sheets and strip, which, though increasing, are not as heavy as had been expected.

Another evidence is to be found in the scrap market. While prices are much higher in a number of centers, the Pittsburgh market, which was on the verge of boiling over last week, has quieted down somewhat, the price of No. 1 heavy melting steel there being unchanged. However, advances at Chicago and Philadelphia have raised THE IRON AGE steel scrap composite price to $17.92, a gain of 34c. and topping the previous 1940 high by 25c.

THE Italian government has bought 250,000 tons of steel scrap in this country for shipment over the next few months on the basis of THE IRON AGE scrap composite price, the method that has been used by the British since last November. Italy has also made large purchases of steel within the past week.

Allied steel purchases total about half a million tons, part of which is in the form of ingots and semi-finished steel and the remainder is finished steel, which includes a large tonnage of ship plates and moderate quantities of shell steel for France. Steel companies expect that Allied purchases, direct and indirect, may run as much as 500,000 tons a month for the duration of the war. A part of this would be for shell contracts, a number of which may be placed soon with American companies. Bids are being taken by the French on 90 mm. shells and by the British on 4-in., 6-in., 8-in., 10-in., 12-in., and 18-in.

The defense program of the United States has not yet proceeded far enough to become a factor in steel trade, except that some items which were already scheduled are being hastened.

Obstacles to a rapid consummation of plans for airplane and armament manufacture are several, chief of which is the shortage of machine tools and motors. Despite the "farming out" of considerable work, machine tool builders are not catching up on deliveries, which in many instances extend to the end of the year and beyond, and they are hampered in increasing output by a shortage of skilled workers, particularly precision workers. In the steel industry there is insufficient capacity for the production of armor plate and electric furnace steel in the quantities in which these products will be required. Many machine companies are stepping up apprentice training to cope with the acute shortage of mechanics, an example of which is the fact that an airplane engine plant has need of 5000 trained men which it has been unable to get.

UNITED STATES Government work will, of course, obtain priority, but in many instances this can only be done at the expense of the Allies, whose orders for machine tools have been very heavy.

Continuation of the war would raise the level of buying in industries only indirectly related to war work, as for example the railroads, some of which may engage in equipment programs soon if traffic seems to warrant. The automobile industry is making initial purchases of steel for 1941 models and further orders are expected in the next few weeks, although the effect on this industry of the war and our own defense preparations is yet to be determined. Stimulation of fabricated structural steel and reinforcing bars is expected to result from the Government program, which will require the construction of new manufacturing buildings and other projects.

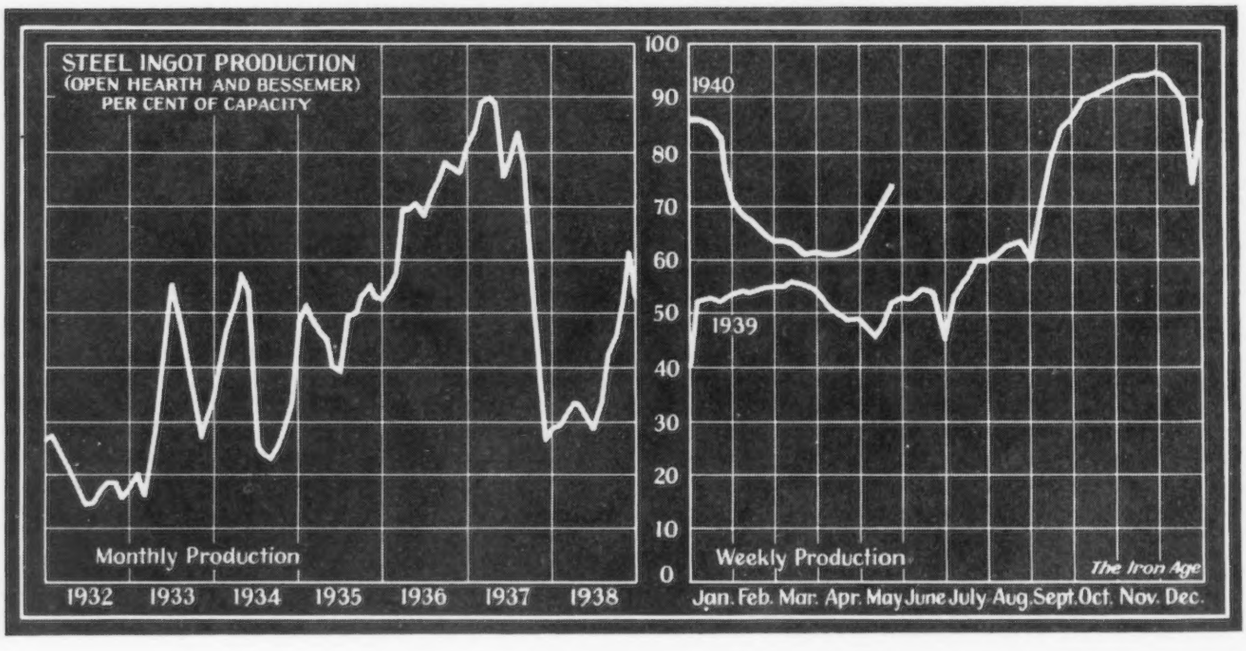
The Industrial Pace . . .

BOUNDING upward 4 points to 74 per cent of capacity, steel operations this week are the highest since the last week of January. This increase, reflecting specifications received against recent low-priced commitments and a higher volume of export business, was accompanied, perhaps sympathetically, by a rise of 34¢ in the scrap composite price. The brighter outlook for the near future engendered by the upward trends of these two sensitive industrial barometers is emphasized by another gain in THE IRON AGE capital goods index. Although restrained by several weak components, the index gained 2.2 points to 74.6 in the past week, bringing the index back to the level prevailing at the close of March. The steel output series showed the heaviest gain in the week, followed by the lumber series. The week's loss in the heavy construction series is largely a reflection of lessened public activity. Private construction contracts awarded in the past week were $20,754,000, or 16 per cent above the preceding week and the seventh consecutive weekly gain. Public work dropped 23 per cent in the week. Utility plant expansion accounted for a large part of the week's increase in private awards. Total construction contracts placed for the year to date show a loss of 17 per cent from the volume of the corresponding period of 1939, but this again is due entirely to public works, for privately financed work is running 17 per cent above a year ago.

Freight carloadings of lumber rose sharply in the past week in a contraseasonal movement. This series, which reflects largely the construction of small buildings and general repair work, has been the outstanding laggard in the recent upward movement of the index. On a seasonal experience basis, the spring peak has been passed, but it is quite likely that because of the extreme wet weather and late arrival of warm weather, that loadings may continue to rise as the spring and summer building activity gets under way. The gain in this component in the past week establishes it above the level of both a month ago and a year ago.

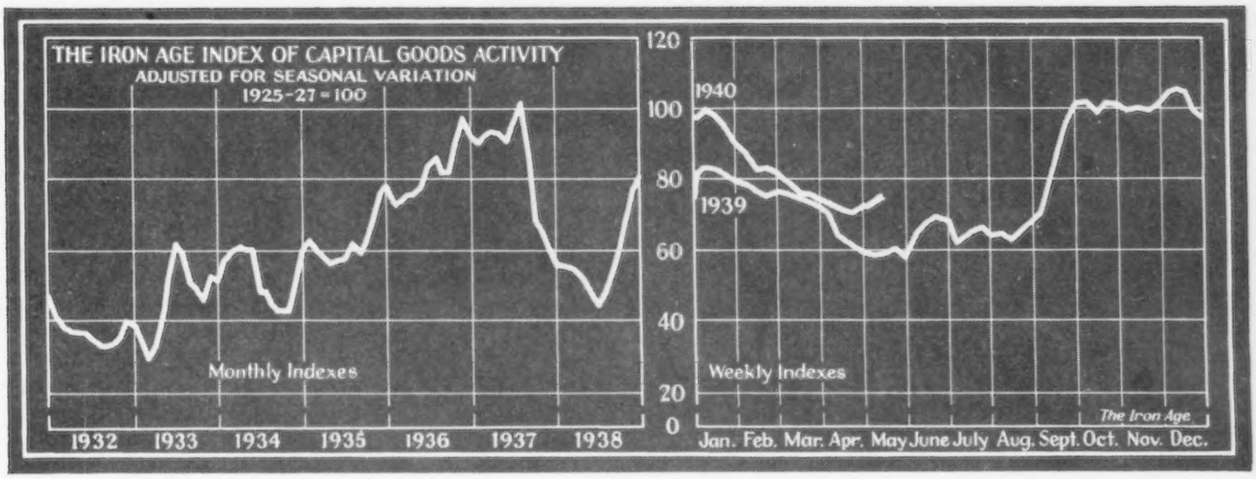
It is significant to note that while, on a tonnage basis, shipments of United States Steel Corp. in April were lower than in March, adjustment for the short work period in April reveals that the month's shipments represented 57.1 per cent of the corporation's rolled and finished steel capacity, as against 56.8 in March. This is the first increase shown since November, 1939, when the year's high point of 86.1 per cent was reached.

Steel Production Rises to 74 Per Cent



District Ingot Production, Per Cent of Capacity	Pitts-burgh	Chicago	Valleys	Phila-delphia	Cleve-land	Buffalo	Wheel-ing	Detroit	Southern	S. Ohio River	West-ern	St. Louis	East-ern	Aggre-gate
Current Week	73.0	75.0	65.0	77.0	74.0	76.5	95.0	81.5	81.5	75.0	71.0	64.5	48.0	**74.0**
Previous Week	66.0	71.5	62.0	75.0	73.0	64.5	94.0	81.5	81.5	72.0	70.0	52.0	50.0	**70.0**

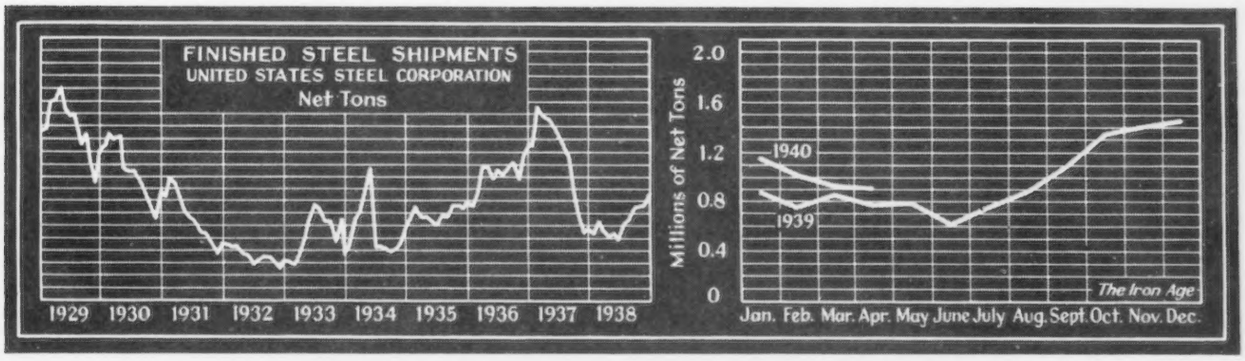
Improvement Continues in Capital Goods Output



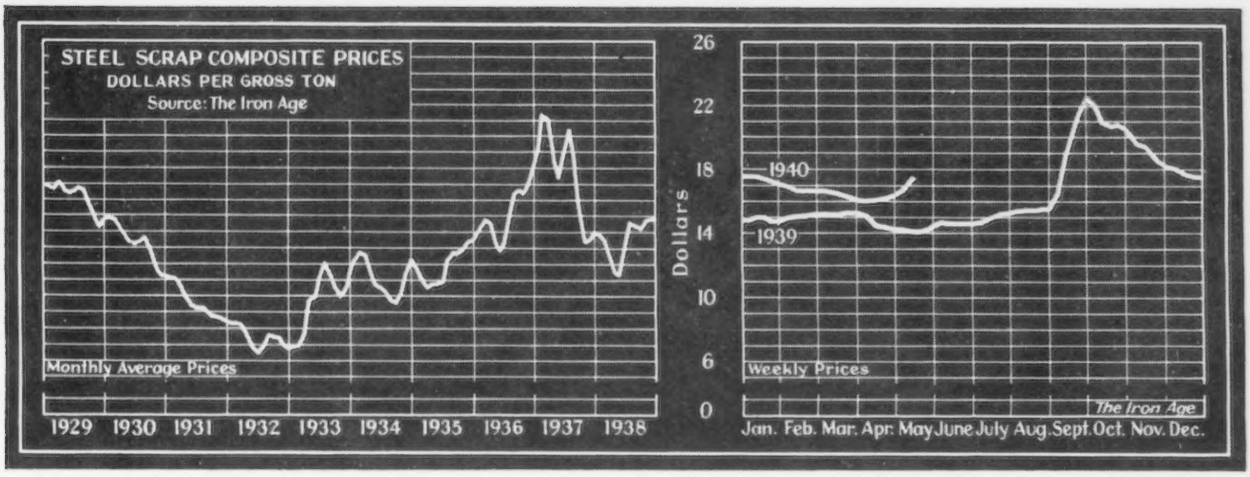
¥Components — Week Ended →	May 18	May 11	Apr. 20	May 20 1939	May 18 1929
Steel ingot production[1]	90.8	86.2	79.8	58.6	129.0
Automobile production[2]	83.7	82.3	84.1	67.8	128.9
Construction contracts[3]	52.4	52.7	56.6	74.0	126.1
Forest products carloadings[4]	58.9	55.1	55.4	54.0	122.8
Pittsburgh shipments and output[5]	87.4	85.5	83.8	42.4	124.7
COMBINED INDEX	74.6	72.4	71.9	59.4	126.3

Sources: [1] THE IRON AGE; [2] Wards Automotive Reports; [3] *Engineering News-Record*; [4] Association of American Railroads; [5] University of Pittsburgh. The indexes of forest products carloadings and activity in the Pittsburgh area reflect conditions as of the week ended May 11. Other indexes cover the week of May 18.

U. S. Steel Shipments Little Changed in April



Scrap Prices Rise Sharply in First Half of May



Market News

. . . THE WEEK'S ACTIVITIES IN IRON AND STEEL

STEEL OPERATIONS

. . . Rate for industry advances four points to 74% of capacity

WITH NO EXCEPTIONS OF IMPORTANCE, every steel producing district is operating at a higher rate this week. The net result is a gain of four points to 74 per cent in the average rate for the industry as estimated by THE IRON AGE.

Examples of the rate increases are: PITTSBURGH, up six points to 73 per cent; CHICAGO, up three and a half points to 75 per cent; YOUNGSTOWN, up three points to 65 per cent; EASTERN PENNSYLVANIA, up two points to 77 per cent; CLEVELAND, up one point to 74 per cent; BUFFALO, up 12 points to 76½ per cent; WHEELING-WEIRTON, up one point to 95 per cent; SOUTHERN OHIO up three points to 75 per cent; ST. LOUIS, up 12½ points to 64½ per cent.

The current steel operating rate is the highest since the last week of January and the gains have been accompanied by the blowing in of a number of blast furnaces.

NEW BUSINESS

. . . Sales are substantially heavier, both export and domestic

BOOKINGS AT PITTSBURGH continue to expand, with increases noted in both export and domestic demand. Further substantial gains are expected soon in the volume of orders from England and France, these countries turning to the United States for supplies formerly obtained from Belgium and Luxembourg. Initial placements from the Allies in the past 10 days have been substantial.

The volume of specifications is expected to be exceptionally heavy in June owing to last minute rush of sheet and strip customers to send in shipping instructions in time for June 30 delivery. On top of this expected rush will be a quicker tempo in specifying by all steel customers in view of present domestic and world-wide conditions.

At CLEVELAND it is noted that world events of the last two weeks have served to clear away much of the indecision which was delaying purchases of steel and machinery, plant expansion and payroll additions. Aircraft parts makers and machine tool producers at CLEVELAND were quick to grasp the full significance of the task confronting this nation in seeking to rearm.

LARGE INCREASES ARE SHOWN in orders for such semi-finished steel items as rerolling and forging billets, sheet bars and skelp. Automotive buying for June delivery is heavy, and it appears a large percentage of requirements for 1941 models may be on order soon. Meanwhile, railroads are watching developments closely and will advance their plans for equipment purchases if a tight steel situation develops.

Deliveries from steel mills at CLEVELAND and YOUNGSTOWN are fairly prompt at present except for tin plate, but are gradually growing more extended. A number of consumers with ready cash have indicated they will undertake to build up their inventories.

NEW BUSINESS AT CHICAGO has been showing substantial gains for several weeks, and bookings for the month to date are from 40 to 90 per cent ahead of the same period in April. Specifications against low priced sheet commitments are an important factor in this general upturn, but all products are in active demand. Much of the buying appears to be going into stocks, though there has been of late an improvement in general manufacturing.

New business booked by Philadelphia sellers in the past week was slightly less than in the preceding week, but shipments against existing commitments were substantially higher, in some cases the highest for the year to date. Considerable effort is still directed toward driving in specifications on low-priced blanket orders. This drive is meeting with varying degrees of success. Some sellers report

NEW YORK SALES are substantially heavier, and it is indicated from results to date that the tonnages booked in May may be about double those of April. However, a note of hesitancy

With substantial tonnages to be required for military construction by the Federal Government, continued brisk activity is in view on the Pacific Coast, Alaska, and island possessions. Substantial reinforcing steel tonnages were booked during the week, and further concrete bar work promises business for several weeks ahead, although prices continue soft. Private construction is taking larger tonnages than in some time, but is, of course, dwarfed by the huge government program.

PIG IRON

. . . Higher scrap prices, ingot output help spotty market

THE MARKET this week shows spotty improvement, due to higher scrap prices, an upturn in steel ingot production which is likely to leave fewer blast furnaces to supply the merchant trade, and an irregularly higher foundry melt. Orders have started to pick up at CLEVELAND, where May deliveries are running ahead of April, and at CHICAGO, where four blast furnaces have been blown in the last two weeks and a fifth is expected to be blown in shortly. CHICAGO shipments in May are considerably ahead of April, foundry coke shipments there are also improved, and higher activity of foundries supplying machine tool and jobbing shops is offsetting the slowdown of automobile foundries as the model changeover time approaches.

Orders and shipments show little change at PITTSBURGH, where two stacks were blown in the past week. For the first time in several months, PHILADELPHIA district pig iron users are showing an interest in the market, with a number of 500-ton orders placed for second quarter delivery, and May shipments likely to be the highest so far in 1940. Sellers in most areas, such as NEW YORK, look for prices to be unchanged for the third quarter.

The British have placed some orders but the export situation continues highly confused and substantial buying which is expected has not yet appeared.

New orders continue light in NEW ENGLAND and in the SOUTHERN OHIO area but BUFFALO and ST. LOUIS report improvement. Shipments in the ST. LOUIS territory in May, may be 25 per cent above April, due partly to activity created by the war.

SHEETS AND STRIP

. . . Consumers still delay in specifying against commitments

ALTHOUGH SHEET AND STRIP specifications at PITTSBURGH are substantially ahead of a month ago, large buyers are still delaying in sending in releases against low priced commitments. Demand from miscellaneous consumers is at a fairly good rate.

Sheet makers have eliminated the 10c a 100 lb. extra on coils of cold rolled sheets and certain single pickle and annealed hot rolled sheets. The official elimination takes care of a condition which has been more or less nominal since the change was instituted late last year.

Orders are coming in freely at CLEVELAND and YOUNGSTOWN. Deliveries are still fairly prompt but hold promise of growing more extended in the next few weeks. Mid-May buying on the part of automobile producers for June delivery has been good. While some motor car producers have already contracted for a portion of their requirements for 1941 models, certain sizes, such as those required for bumper stock, will not be available for a few more weeks.

At CHICAGO, less than half the tonnage represented by blanket orders at the $4 reduction has been specified, some offices having received considerably less than half.

Operations in the sheet and tin mills of one large CHICAGO producer advanced last week from 95½ turns to 105½ turns. The increase is in the wide hot strip mill, the hot sheet mill, the galvanizing shop and the tin house.

In SOUTHERN OHIO specifications against commitments for sheets and strip have increased noticeably during the past week as consumers seek to clear up commitments before the June 30 date. A small amount of urgency contracting is reported, but mill interests indicate that this is largely for filling up gaps in the present inventories and contracts. Sheet mills are running close to 90 per cent of capacity under the impetus of increased specifications.

New York sheet and strip sellers are finding some difficulty in persuading their customers to specify for all of the material that was covered in the recent blanket commitments. Among some steel buyers is apparently a feeling of caution against loading up too heavily with inventory in the event that the war in Europe ends within a short time.

TUBULAR GOODS

. . . Business this month slightly ahead of April volume

OIL COUNTRY GOODS SALES AT PITTSBURGH compare favorably with the volume booked a month ago, and the moderate gain in merchant pipe demand has held in the past week. Total tubular goods sales so far this month reflect some expansion from a month ago, but do not match the activity present in some other steel markets.

At CLEVELAND and YOUNGSTOWN up to May 20 new business on the daily basis was comfortably ahead of the corresponding part of April and from all indications this month will end with a gain. Large awards have been infrequent during the past week, but some jobbers and oil companies show a disposition to maintain higher inventories now that the Allies will be relying upon the United States for heavy steel more than ever.

The Bureau of Supplies and Accounts, Navy Department, opened bids on Tuesday of the present week for 1,030,000 ft. of black and galvanized welded and seamless steel pipe, ⅛ in. to 8 in. in diameter; 87,000 ft. of black and galvanized wrought iron pipe, ⅜ in. to 6 in. in diameter, and about 900 ft. of seamless tubing .54 in. to 7.625 in. in diameter. The material is to be delivered to the various navy yards.

The Department of the Interior has awarded a $78,895 contract to the Western Pipe & Steel Co., Los Angeles, for outlet pipe for the Friant dam in California and 1267 tons to the Bethlehem Steel Co. for the Grand Coulee Dam.

COLUMBIA GAS & ELECTRIC CORP. has divided 112 miles of 16-in., 10-in. and 8-in. pipe among Jones & Laughlin, National Tube, Youngstown Sheet & Tube and Republic Steel, representing a 10,000-ton gas pipe line to run from Beaver County, Pa., to the New York State line at Bradford, Pa., the pipe will not be supplied, however, until proper approval of regulatory authorities has been obtained, hence the order is classified as tentative until approvals are forthcoming. The line will supply West Virginia gas to Columbia Gas territory in New York State.

STRUCTURAL STEEL

. . . Lettings are 10,650 tons, new projects about the same

FABRICATED STRUCTURAL STEEL lettings declined to 10,650 tons from 22,250 tons last week. The bulk of awards was in small lots, the only one of size being 1500 tons for the Dookers Hollow bridge at Bessemer, Pa.

New structural steel projects are higher at 10,300 tons. The outstanding inquiries are 1350 tons for two grade elimination bridges at Detroit; 1300 tons for the Schaefer Brewing Co., Brooklyn, and a warehouse at Kearney, N. J., for the American Stores Co.

Preliminary plans have been approved for a bridge in St. Louis County, Mo., across the Mississippi River, of wire cable type construction, to cost about $3,500,000. Sverdup & Parcel, St. Louis, are the engineers.

Weekly Bookings of Construction Steel

	Week Ended				Year to Date	
	May 21, 1940	May 14, 1940	Apr.23, 1940	May 23, 1939	1940	1939
Fabricated structural steel awards	10,620	22,250	13,000	12,850	292,680	378,910
Fabricated plate awards	1,910	1,920	2,410	2,020	59,005	70,200
Steel sheet piling awards	0	425	2,000	0	16,290	21,605
Reinforcing bar awards	13,150	7,050	4,510	10,400	168,800	196,145
Total Letting of Construction Steel	25,680	31,645	21,920	25,270	536,775	666,860

RAILROAD BUYING

. . . Great Northern orders 1000 cars, May buy 1000 more

GREAT NORTHERN HAS ORDERED 1000 box cars from Pullman-Standard Car Mfg. Co., and is taking bids on an additional 1000 cars. This is the first important car purchase made since the New York Central purchase of 1500 cars in early April. U. S. War Department is taking bids on 50 tank cars for gasoline transportation and Western Railway of Alabama is seeking prices on two baggage-express cars. American Car & Foundry Co. was low on recent bidding on two baggage cars and two coaches for Alaska Railroad.

There was also increased activity in the locomotive market in the past week. St. Louis Terminal Railway ordered 10 diesel-electric locomotives, six being awarded to Electro-Motive Corp., two to Baldwin Locomotive Works and two to American Locomotive Co. New inquiries include 11-diesel-electric locomotives for U. S. Navy Department, four or seven steam locomotives for Detroit, Toledo & Ironton, 12 articulated units for Western Maryland and four steam locomotives for Lourenco Marques System, East Africa.

The Missouri Pacific Railway has been authorized by the Federal Court at St. Louis to buy 30 covered 70-ton hopper cars for cement loading at estimated cost of $3,849 each.

CLASS 1 RAILROADS in the first four months of 1940 put into service 27,809 new freight cars, the largest number installed in any corresponding period since 1930, the Association of American Railroads reports. In the first four months of 1939, 6817 new cars were installed, and in the same period of 1938, 5302 cars were put into service. New freight cars on order on May 1 totaled 17,460, as compared with 6391 on May 1, 1939.

Steam locomotives put into service in the first four months amounted to 27, while 88 diesel and electric locomotives were installed in the period.

MERCHANT BARS

. . . Mild upward trend in sales, export demand a factor

BAR SALES AT PITTSBURGH in the past week reflect a mild upward trend, due in some cases to consumers specifying at a slightly faster pace owing to current world conditions. Demand has been miscellaneous with some last minute fill-in orders from auto centers. Export business remains an important factor with the likelihood of increased order volume from France and England, as well as from neutral countries which are seeking new sources of supply.

Orders for bars at CHICAGO sales offices have shown great improvement in the past two weeks. Tractor and implement plants are taking tonnages regularly, as are also the automotive industry, warehouses, forgers, cold finishing mills, and miscellaneous buyers.

With some consumers showing a disposition to build up their inventories, merchant bar sales at CLEVELAND and YOUNGSTOWN up to May 20 were running approximately 20 per cent ahead of the comparable April period on the day to day basis. Foreign inquiries are reported well sustained.

TIN PLATE

. . . Operations higher at 70% . . . Chicago mills near capacity

TIN PLATE OPERATIONS this week are up two points to 70 per cent and there is evidence of further quickening in domestic demand. Present world conditions are causing some can makers to actively consider adding to tin plate stocks, but so far no unusual action has been taken. Foreign requirements have changed but little in the past few weeks, but tin plate makers look for mild improvement soon from that quarter.

Tin plate operations at CHICAGO are continuing at near capacity and prospects are good for the maintenance of this trend.

PLATES

. . . Business better at Pittsburgh and Chicago, slow in East

PLATE BUSINESS AT PITTSBURGH is ahead of a month ago. Some of this past week's volume has come from fabricators who are building up stocks in expectation that deliveries might not be so free several weeks from now. Specifications are heavier, owing to construction projects and shipbuilding. If a large freight car buying program should develop, most plate mills would be able to operate fairly good levels. Export demand has increased in the past 10 days.

Plate sales at CLEVELAND up to May 20 were slightly behind the incoming volume in the same part of April, a situation which is in marked contrast with most other steel divisions. While miscellaneous buying has been good, individual tonnages have been small. A day or two of brisk activity could easily change the picture quite sharply.

Tonnage from railroad car shops, tank builders, and structural fabricators has been received at CHICAGO recently, total bookings showing an improvement over the previous week.

SALES IN EASTERN PENNSYLVANIA area in the past week were very spotty. Some sellers reported a slightly better demand from warehouses and fabricators, while other sellers reported the week's business as being the poorest of any week of the current year. Railroad purchases, an important factor in the district market, continue very light, but there are expectations that several new equipment programs may materialize in the next 30 days if the present upward trend of carloadings is maintained. Several Swiss inquiries are still in the market, but otherwise European demand is very slow. Sales to South America continue to expand slowly. Elimination of Belgium from export market is expected to further increase South American demand.

Pacific Coast plate fabricators face a better outlook than for some time. Bids were opened last week on the first of several water conduit projects in southern California, and further inquiries for this business will require several thousand tons additional.

REINFORCING STEEL

. . . Awards and inquiries are in good volume

REINFORCING STEEL AWARDS advanced to 13,150 tons and include 4780 tons for Los Angeles River improvements at Los Angeles; 2000 tons for the Long Island Railroad subway in Brooklyn, and 1265 tons for the Grand Coulee Dam at Odair, Wash.

Among 17,210 tons of new reinforcing steel projects are 5900 tons for

fleet supply storehouses at Oakland, Cal.; 2500 tons for the Goldblatt Brothers store, Chicago, and 1000 tons for a wharf at Oakland for the fleet supply base.

While jobs are still going at from 1.60c. a lb. to 1.90c. a lb., f.o.b. major basing points, it has been noted in the past week that "wide open" soft spots have been disappearing, probably indicative of the increased volume of general steel bookings. Whether the latter will exert enough influence to drag concrete bar prices up to higher levels and finally to the so-called published prices remains to be seen, although this has happened infrequently in the past when total steel demand reached peak levels.

One of the largest pending jobs in the CHICAGO district, 1200 tons of bars for Mississippi dam and lock improvements, has been postponed indefinitely. About 1700 bars is expected to be needed for the superstructure of the Northwestern Technological Institute.

WIRE PRODUCTS

. . . Government orders feature an increase in total sales

INQUIRIES FOR WIRE from United States Government sources are a market highlight at CLEVELAND, where aggregate bookings so far this month show a good-sized increase over the first 20 days of April, but remain considerably below capacity. Panama and South America are active on the export side. Domestic users of rods and manufacturers' wire show a disposition to build up their inventories. All indications point to a good rate of activity through June, even though operations at present are not up to the average of the entire steel industry. As stated last week, the spirited price war on nails has been growing less serious gradually.

Wire sales at PITTSBURGH are running moderately ahead of the same number of days last month. Expansion in sales volume this past week reflects a heavier demand for manufacturers' wire, fence, nails and wire rods. Some of the business lost earlier in the year because of weather conditions is now being partially made up. Export requirements are holding at recent levels with indications pointing toward further improvement.

Total orders at CHICAGO this month to date are well ahead of the same period in April. Increasingly large tonnages are coming in week by week from country jobbers. Demand from industrial consumers centers primarily around parts makers for automobiles.

IRON ORE

. . . April consumption lower but stocks are reduced

CONSUMPTION OF LAKE SUPERIOR IRON ORE in April totaled 3,934,853 gross tons, a decline of around 152,000 tons from the March figure of 4,087,767 tons, but an increase of 1,135,084 tons from April, 1939, consumption. For 1940 up to May 1, cumulative consumption was 17,553,767 tons, against 11,895,706 tons in 1939 up to May 1. The figures are compiled by the Lake Superior Iron Ore Association, Cleveland.

Ore on hand at furnaces and Lake Erie docks May 1 totaled only 18,106,151 gross tons, against 21,862,302 tons a month earlier and 22,790,933 tons May 1, 1939. On April 30 there were 121 furnaces in blast depending principally on Lake Superior iron ore, against 119 a month earlier, according to the association.

SEMI-FINISHED STEEL

. . . Large orders from Allies supplemented by domestic sales

TOTAL SEMI-FINISHED STEEL orders so far this month have been double or more than the volume placed in the same period last month. Much of this gain has been due to export buying, which has increased substantially in the past 10 days. Evidence is available that some non-integrated steel makers are taking in steel promptly, which in some cases is a hedge against possible tightness in supplies later on. Skelp volume is slightly better than a month ago and reflects seasonal gains in merchant pipe business. Wire rod order volume has expanded moderately in the past week with indications of further increases, some of which stems from export demand. If steel operations keep climbing, some companies, now actively selling billets, blooms and slabs, may have to withdraw from the market, as they will need all their semi-finished for their own operations.

At CLEVELAND and YOUNGSTOWN, sales of semi-finished steel up to May 20 showed a sharp increase in contrast to the corresponding part of April. This is particularly true at CLEVELAND where sales of rerolling billets and sheet bars have been exceptionally heavy, followed by forging billets and skelp. Orders for some of these items are several hundred per cent better. Large inquiries from the Allies continue to be received.

. . . EXPORT TRADE . . .

. . . Allies place large orders here
. . . Italy also a buyer

SINCE THE INVASION of Holland, Belgium and Luxemburg the Allies have purchased several hundred thousand tons of steel in the United States. This action was in line with expectations as a sizable amount of steel had been furnished by Belgium-Luxemburg, which is no longer a source of supply. Most of the steel placed in the past 10 days was semi-finished, although a moderate amount of French shell steel has also been bought. A large order for ship plates for France was also placed.

American steel makers this week had before them inquiries from France calling for more than 100,000 tons of various types of common steel, such as billets, plates, bars, etc.

SOME STEEL PEOPLE believe that Allied orders, direct and indirect, may run as much as 500,000 tons a month for the duration of the war. This presumably would include shell steel to be bought by American companies which receive shell contracts. The minimum amount expected is 200,000 to 300,000 tons a month, exclusive of shell steel bookings.

Italy also appeared in this market in the past week as a large buyer of steel, in addition to contracts for scrap placed with several scrap companies.

It is expected that French shell steel orders will be placed continuously as soon as a few questions on prices and specifications have been ironed out, although latest information indicates that these points have either been adjudicated or have about reached that stage.

Machine Tools

. . . SALES, INQUIRIES AND MARKET NEWS

Further Aircraft Buying Due

New York

• • • **As a result of** the huge preparedness program being rushed through Congress, it is expected that further large scale buying of machine tools on the part of the aircraft engine builders in the East will follow in the near future. The two big engine builders on the Eastern seaboard were already making heavy commitments in connection with the recently placed contracts of the Anglo-French Purchasing Commission—the third expansion program—when the "all out" war broke out and precipitated the President's action in calling for an additional billion dollars for defense. The only situation that might take away additional buying from the local market would be the location of new aircraft plants inland. Such plants would necessarily be branch plants of the present builders, since years of development work are required to bring out new designs.

Many large industrial plants in the New York area are figuring on munitions work for the Allies. Practically no machine tool buying has taken place in connection with the only contract definitely known to have been awarded in this territory, namely that to the American Car & Foundry Co. Because of the delivery situation on new machinery, the company is inquiring for used machine tools, besides concentrating at Buffalo all equipment not now in use in other plants that is suitable for shell work. Military work for the U. S. Government is likely to overshadow in importance any contracts from the belligerents. The bulk of machine tool sales activity in recent weeks has been related to the war in one way or another.

Heavy Bookings in West

Chicago

• • • **Inquiries and orders** are holding up well in this district, and the month to date compares favorably with the previous 30-day period. The Rock Island Arsenal is inquiring for a small lathe and a milling machine, but no large scale interest is expected from this source until after the July 1 appropriation becomes available. At that time, probably considerably more equipment will be purchased than was believed a few months ago, because of the sudden turn of events abroad.

District machine tool plants are all booked far in advance, many with a large proportion of foreign orders. New block orders for machines that may possibly arise from the seriousness of the German invasion and our own recent determination to strengthen defense facilities cannot expect to receive shipment much before the end of the year, if then, unless special priority is demanded by the Government.

Foreign Orders Predominate

Cincinnati

• • • **With new business** in machinery continuing unabated, manufacturers generally were watching war news during the past week. Backlogs are continuing to pile up and delivery dates appear to become longer each week. Of course, a possibility of cessation of hostilities or a peace proposal in the present war, caused the trade generally to do some appraisal of present conditions in the light of the possibility. Defense preparations in the United States tended to minimize any pessimism aroused over possibility of cancellation of foreign war orders.

The past week showed relatively no change from the previous week, with foreign volume of orders still outweighing slightly those from domestic sources. While machine tool production is being geared to the present available skilled labor, manufacturers indicate there is still room for a substantial number of more men.

Decided Upturn at Cleveland

Cleveland

• • • **Producers report** a very decided upturn in both orders and inquiries during the past week, evidently the result of world development which have eliminated any uncertainties over whether the war is bona fide and what this nation will do in the way of rearming. The new business is heavy on the aircraft side.

The new orders are having the effect of "freezing" schedules for the next six months. In other words, the holes which had been left purposely are being filled in rapidly.

Outside of aircraft, business has been good from tractor and truck makers and Detroit tool shops.

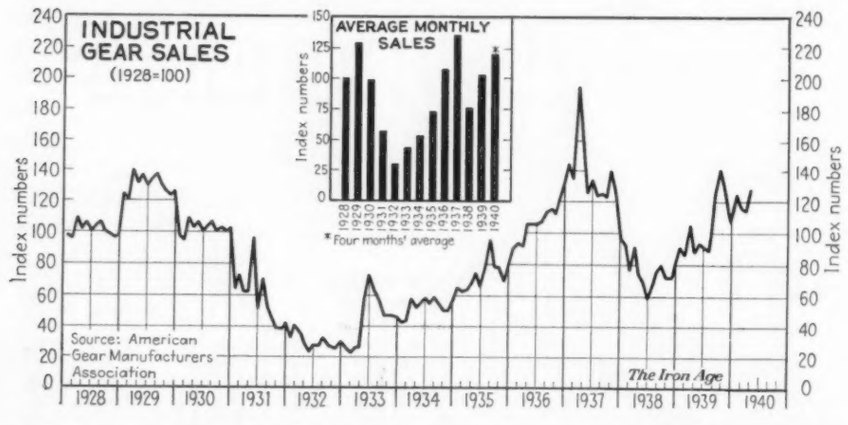
The used machinery market remains very active.

April Gear Sales Highest Since October, 1939

SALES of industrial gears in April rose 12 per cent over the March volume and were the heaviest since October, 1939, according to data collected by the American Gear Manufacturers Association. Sales for the first four months of the present year are 30 per cent above the comparable period of 1939.

The index of sales for April (based on 1928 = 100) was 128, as compared with 114 in March and 88 in April, 1939. Average index for the first four months of 1940 is 120, against 92 for the corresponding period in 1939.

Last August the index began to shoot upward, rising from 89 in July to 141 in October, the year's highest index position, then slumped off to a low of 114 in March of this year.



Non-Ferrous Metals

. . . MARKET ACTIVITIES AND PRICE TRENDS

New York, May 21—The market last week was torn by bullishness over prospects of heavier purchases by Allies and bearishness over the adversities suffered by the Allies. Developing domestic rearmament program was also a factor on the bullish side. Despite the apparent preponderance of news suggesting an intensified call for non-ferrous metals in the near future, the markets generally closed the week in a soft position. Copper sales, which had held up moderately well all week, slumped off yesterday and today. Electrolytic prices, which had been firm most of the past week at 11.50c., delivered Connecticut Valley, reflected this easiness by declining to 11.375c. over the week end. This latter price was offered by custom smelters and resale interests but mine producers adhered to the 11.50c.-level. Copper sales for the month through Saturday total 44,165 tons, or almost double that of the corresponding period of April. Export sales were in moderate volume all week, with prices slipping off to around 11.35c. per lb., f.a.s., early this week in sympathy with the softness in domestic quotations.

Lead

Consumers bought actively all the past week in June positions, but demand was very irregular in the first two days of the present week. The heavy buying over the past several weeks has given consumers close to 100 per cent coverage of May needs and about 75 per cent of June requirements. A period of quiet is expected until the July books are opened early next week. Quotations were unchanged all week at 5c. per lb. New York. The developments abroad have eliminated much of the foreign supplies heretofore available in this market and has given rise to some export demand here.

Zinc

Sales of Prime Western metal in the past week totaled 9594 tons, against 8624 tons in the previous week and 1285 tons three weeks ago. The sales were fairly evenly distributed over the next three months and largely represented protective covering as consumption here has not shown any material improvement lately. The week's shipments were 3972 tons, practically unchanged from the preceding week. Domestic prices remained unchanged all week at 6.14c. per lb., New York. Export demand is growing in volume and some sellers foresee the possibility of the sizable export movement in the near future, due largely to the removal of Belgium competition from world markets.

Tin

Sales in the past week were extremely erratic in that one day there would be a very active demand, while the following day would be almost completely devoid of inquiry. Quite likely the varying aspects of the war has been exerting sharp changes in buying sentiment. However, the week's total sales, representing mostly consumer buying of nearby positions, were very heavy. The preference of consumers for physical tin, rather than futures contracts, has created a tight spot position and has created a premium of about 3c. per lb. for spot over August deliveries. Straits tin today is quoted at 54c. per lb., New York, while cast standards were quoted this morning in London on first call in the neighborhood of £270 10s.

Non-Ferrous Metal Prices on page 111

Scrap . . . MARKET ACTIVITIES AND QUOTATION TRENDS

THE ITALIAN GOVERNMENT has bought about 250,000 tons of steel scrap, the business having been divided, it is reported, among four exporters. The sales have been made on the basis of THE IRON AGE steel scrap composite price, following the plan that was adopted by the British last November for sliding scale purchases. Italy has also been a large buyer of finished steel products during the past week.

Advances of 50c. a ton at Chicago and Philadelphia have raised THE IRON AGE steel scrap composite price to a new 1940 high of $17.92, the previous peak this year having been $17.67, which obtained during the first three weeks of January.

Most of the major markets are higher this week, Pittsburgh being an exception. In that center both dealers and mills are holding to the sidelines to await a clarification of the situation, which has taken on signs of a runaway market.

Pittsburgh

The market continues strong but No. 1 heavy melting quotations are unchanged this week at $18.50 to $19 a ton, with buyers and sellers alike on the sidelines awaiting clarification. Brokers are hesitant to sell short, while some buyers are reluctant to make offers, feeling that the market might possibly stage a runaway. Supplies continue scarce and added strength has appeared in low phos grades. Railroad heavy melting is stronger but the spread between this grade and ordinary No. 1 is expected to be narrowed soon.

Chicago

Brokers are offering $17.25 and $17.50 to dealers for No. 1 steel, and have paid up to $17.75. A small railroad list last week brought around $18.75 a gross ton, delivered this district, for heavy melting steel. Dealers report the past two weeks have been exceptionally slow as regards movement of old material into this district. Accounting for this may be the fact that though steel mills are operating at high rates, many of the factories which produce industrial scrap are running less than full time. Some mill buyers here are offering $17, it is understood. With mill operations high and scheduled to go even higher, every producer in this district is a potential customer and it is this possibility, combined with the war and the stock market, that has the trade here so jittery. In recognition of current broker-dealer trading No. 1 is quoted this week at $17 to $17.50.

Philadelphia

The market here is still very strong, although trading is very light. Most district mills are fairly well stocked in consideration of present operations, and are very cautious in making additional commitments in an effort to avoid a repetition of last fall's runaway market. Brokers generally are paying $17.50 in covering on recent orders and $18 has been paid by a consumer for No. 1 steel in at least one direction. On the basis of these conditions, quotations on steel making gardes have been advanced 50c. Cast items and railroad specialties are also higher, but blast furnace material and borings are unchanged. It is not expected that much of the recent Italian purchase will be shipped from this district.

Youngstown

The upward trend continues here, although such sales as have come to notice are small. Judging from available reports, the situation as regards scrap supplies is even a little tighter than at other centers, where the rise in prices has caused small dealers to relax their hold. Open-hearth activity is improving week by week, while mid-Ohio electric furnace plants hold unusually large backlogs. No. 1 heavy melting is quoted at $18.50 to $19 a ton this week, up 50c.

Cleveland

All available evidence points to the fact this market is keeping pace with the trend over the nation. During the past week the flow of scrap has been better to the relief of short interests, indicating small dealers are cashing in. No. 1 heavy melting is quoted at $18 to $18.50 a ton, up 50c., in line with actual conditions.

Buffalo

With dealers reluctant to sell at any price, and the market almost barren of sales, values on all scrap items rose nominally 50c. to $1 a ton this week. Resultant price for No. 1 heavy melting steel is $17.50 to $18, and for No. 2 steel $15.50 to $16, allied grades carrying their customary differentials. No. 1 cast is $1 higher.

St. Louis

The St. Louis scrap prices, which had been unchanged for three weeks, went to the other extreme. Every item on the list changing, advancing from 75c. to $2.75 a ton. The advances were made by dealers, who felt impelled to do so to stop the movement of scrap to other markets where higher prices are being paid. Mills are well fortified, and have shown no inclination to buy except at prices not satisfactory to brokers.

Cincinnati

Intensification of the war, combined with some mill interest in scrap, strengthened the general undertone and brought dealers' bids up 50c. on the whole list. Mill interest, however, is not in sizable proportions, but is better than a week ago. Foundry grades are showing greater activity with dealers moving to protect themselves.

Birmingham

Scrap continues to evidence stronger tendencies, although there have been no price changes since last week. Dealers are able to obtain a slightly better volume and a steady stream is moving to fill old orders and in some instances new orders of small tonnage.

Detroit

Brokers are paying 50c. to $1 a ton more for scrap in the Detroit area than they were a week ago, reporting that substantial mill demand is reflected in the higher prices. Support for the increased quotations has been lent by higher prices known to have been paid for hydraulic bundles sold last week by a major body plant. The tonnage is reported to have been split, part of it going to outside buyers and the remainder apparently destined for shipment to points south and east via the Great Lakes. Dealers, for the most part, are reluctant to part with scrap since yard accumulations are small anyhow and automotive plant production is decreasing very rapidly as parts manufacture tapers to the zero point for the model changeovers.

New York

The Italian Government has bought 250,000 tons of steel scrap from four exporters, the material to be shipped over a period of a few months and to be settled for on the basis of THE IRON AGE scrap composite price. The export movement to Great Britain has been slightly better. Domestic scrap prices are governed largely by the price advances elsewhere and are about 50c. a ton higher on all items. Prices being paid for export have also gone up 50c. a ton.

Boston

Demand for domestic delivered scrap has expanded somewhat yet is by no means on a large scale. For Weirton, Pa., delivery brokers are paying $6.40 a ton on cars for steel turnings, and $10.40 for bundled skeleton, $1 a ton more than a week ago. Their price for blast furnace material also is $1 a ton higher at $4.50 a ton on cars. Blast furnace material for Bethlehem, Pa., delivery is being loaded on barges at $5 a ton delivered barge. Stove plate and shafting are 25c. to 50c. higher a ton. For Worcester, Mass., delivery No. 1 heavy melting steel is reported to have sold at $14 a ton, delivered, and No. 2 steel at $12.50.

Toronto

Interest in the Canadian scrap markets continues at fever heat, with dealers predicting early advances in prices. Some dealers are paying above list as a speculation. Considerable improvement is reported in offerings to dealers recently, who state that in addition to meeting current demand they are now starting to increase yard stocks. The automotive wreckers are throwing larger quantities on the market. Premium cast is very scarce.

IRON AND STEEL SCRAP PRICES

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$18.50 to $19.00
Railroad heavy melting	20.00 to 20.50
No. 2 heavy melting	17.00 to 17.50
Railroad scrap rails	19.50 to 20.00
Rails 3 ft. and under	22.00 to 22.50
Comp. sheet steel	18.50 to 19.00
Hand bundled sheets	17.50 to 18.00
Heavy steel axle turn.	16.50 to 17.00
Machine shop turnings	12.50 to 13.00
Short shov. turnings	13.50 to 14.00
Mixed bor. & turn.	9.25 to 9.75
Cast iron borings	9.25 to 9.75
Cast iron carwheels	20.00 to 20.50
Heavy breakable cast.	16.00 to 16.50
No. 1 cupola cast	19.00 to 19.50
RR. knuckles & coup.	22.50 to 23.00
Rail coil springs	22.50 to 23.00
Rail leaf springs	22.50 to 23.00
Rolled steel wheels	22.50 to 23.00
Low phos. billet crops	23.00 to 24.00
Low phos. punching	21.50 to 22.00
Low phos. heavy plate	20.50 to 21.00
Railroad malleable	22.50 to 23.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$17.50 to $18.00
No. 2 hvy. mltng. steel	16.00 to 16.50
Hydraulic bund., new	17.50 to 18.00
Hydraulic bund., old	14.50 to 15.00
Steel rails for rolling	20.50 to 21.00
Cast iron carwheels	20.50 to 21.00
Hvy. breakable cast	19.00 to 19.50
No. 1 cupola cast	20.00 to 20.50
Mixed yard (f'd'y) cast	17.00 to 17.50
Stove plate (steel wks.)	16.00 to 16.50
Railroad malleable	21.00 to 22.00
Machine shop turn.	10.00 to 10.50
No. 1 blast furnace	9.50 to 10.00
Cast borings	10.50 to 11.00
Heavy axle turnings	14.00 to 14.50
No. 1 low phos. hvy.	21.50 to 22.00
Couplers & knuckles	21.50 to 22.00
Rolled steel wheels	21.50 to 22.00
Steel axles	22.50 to 23.00
Shafting	23.00 to 23.50
Spec. iron & steel pipe	16.00 to 16.50
Cast borings (chem.)	14.00 to 14.50

CHICAGO

Delivered to Chicago district consumers:

	Per Gross Ton
Hvy. mltng. steel	$17.00 to $17.50
Auto. hvy. mltng. steel alloy free	16.00 to 16.50
No. 2 auto steel	13.75 to 14.25
Shoveling steel	17.00 to 17.50
Factory bundles	16.50 to 17.00
Dealers' bundles	15.00 to 15.50
No. 1 busheling	16.00 to 16.50
No. 2 busheling, old	8.00 to 8.50
Rolled carwheels	19.50 to 20.00
Railroad tires, cut	19.50 to 20.00
Railroad leaf springs	19.00 to 19.50
Steel coup. & knuckles	19.50 to 20.00
Axle turnings	15.50 to 15.75
Coil springs	19.75 to 20.25
Axle turn. (elec.)	16.50 to 17.00
Low phos. punchings	19.00 to 19.50
Low phos. plates 12 in. and under	18.50 to 19.00
Cast iron borings	10.50 to 11.00
Short shov. turn.	11.75 to 12.25
Machine shop turn.	11.25 to 11.75
Rerolling rails	19.00 to 19.50
Steel rails under 3 ft.	19.25 to 19.75
Steel rails under 2 ft.	21.00 to 21.50
Angle bars steel	20.00 to 20.50
Cast iron carwheels	18.50 to 19.00
Railroad malleable	20.25 to 20.75
Agric. malleable	14.75 to 15.25
	Per Net Ton
Iron car axles	23.50 to 24.00
Steel car axles	22.50 to 23.00
Locomotive tires	15.00 to 15.50
Pipes and flues	11.50 to 12.00
No. 1 machinery cast	16.00 to 16.50
Clean auto. blocks	18.00 to 18.50
No. 1 railroad cast	15.00 to 15.50
No. 1 agric. cast	13.50 to 14.00
Stove plate	11.50 to 12.00
Grate bars	11.50 to 12.00
Brake shoes	11.50 to 12.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$18.50 to $19.00
No. 2 hvy. mltng. steel	17.50 to 18.00
Low phos. plate	21.00 to 21.50
No. 1 busheling	17.75 to 18.25
Hydraulic bundles	18.00 to 18.50
Machine shop turn.	11.00 to 11.50

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$18.00 to $18.50
No. 2 hvy. mltng. steel	17.00 to 17.50
Comp. sheet steel	$17.50 to $18.00
Light bund. stampings	14.50 to 15.00
Drop forge flashings	17.00 to 17.50
Machine shop turn.	10.00 to 10.50
Short shov. turn.	10.50 to 11.00
No. 1 busheling	17.25 to 17.75
Steel axle turnings	16.00 to 16.50
Low phos. billet and bloom crops	22.00 to 22.50
Cast iron borings	10.50 to 11.00
Mixed bor. & turn.	10.50 to 11.00
No. 2 busheling	10.50 to 11.00
No. 1 cupola cast.	20.50 to 21.00
Railroad grate bars	14.25 to 14.75
Stove plate	14.25 to 14.75
Rails under 3 ft.	21.50 to 22.00
Rails for rolling	19.50 to 20.00
Railroad malleable	21.50 to 22.00

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$17.50 to $18.00
No. 2 hvy. mltng. steel	15.50 to 16.00
Scrap rails	19.50 to 20.00
New hvy. b'ndled sheets	15.50 to 16.00
Old hydraul. bundles	13.50 to 14.00
Drop forge flashings	15.50 to 16.00
No. 1 busheling	15.50 to 16.00
Machine shop turn.	11.00 to 11.50
Shov. turnings	12.00 to 12.50
Mixed bor. & turn.	10.50 to 11.00
Cast iron borings	10.50 to 11.00
Knuckles & couplers	20.50 to 21.50
Coil & leaf springs	20.50 to 21.50
Rolled steel wheels	20.50 to 21.50
No. 1 machinery cast	19.50 to 20.00
No. 1 cupola cast	18.50 to 19.00
Stove plate	15.50 to 16.00
Steel rails under 3 ft.	22.50 to 23.00
Cast iron carwheels	18.50 to 19.00
Railroad malleable	20.00 to 20.50

ST. LOUIS

Dealers' buying prices per gross ton delivered to consumer:

Selected hvy. melting	$15.50 to $16.00
No. 1 hvy. melting	15.00 to 15.50
No. 2 hvy. melting	15.00 to 15.50
No. 1 locomotive tires	15.75 to 16.25
Misc. stand. sec. rails	17.00 to 17.50
Railroad springs	16.25 to 16.75
Bundled sheets	10.50 to 11.00
No. 1 busheling	13.00 to 13.50
Cast bor. & turn.	6.25 to 6.75
Machine shop turn.	7.50 to 8.00
Heavy turnings	10.50 to 11.00
Rails for rolling	18.50 to 19.00
Steel car axles	19.50 to 20.00
No. 1 RR wrought	12.00 to 12.50
No. 2 RR wrought	14.00 to 14.50
Steel rails under 3 ft.	18.75 to 19.25
Steel angle bars	17.50 to 18.00
Cast iron carwheels	15.50 to 16.00
No. 1 machinery cast	16.75 to 17.25
Railroad malleable	17.00 to 17.50
Breakable cast	16.00 to 16.50
Stove plate	11.50 to 12.00
Grate bars	11.50 to 12.00
Brake shoes	11.00 to 11.50

CINCINNATI

Dealers' buying prices per gross ton at yards:

No. 1 hvy. mltng. steel	$13.25 to $13.75
No. 2 hvy. mltng. steel	11.25 to 11.75
Scrap rails for mltng.	17.75 to 18.25
Loose sheet clippings	8.75 to 9.25
Hydrau. b'ndled sheets	12.75 to 13.25
Cast iron borings	4.50 to 5.00
Machine shop turn.	5.75 to 6.00
No. 1 busheling	9.75 to 10.25
No. 2 busheling	3.75 to 4.00
Rails for rolling	19.25 to 19.75
No. 1 locomotive tires	14.75 to 15.25
Short rails	19.75 to 20.25
Cast iron carwheels	15.25 to 15.75
No. 1 machinery cast	16.75 to 17.25
No. 1 railroad cast	14.75 to 15.25
Burnt cast	8.50 to 9.00
Stove plates	8.50 to 9.00
Agricul. malleable	13.25 to 13.75
Railroad malleable	16.25 to 16.75
Mixed hvy. cast	14.25 to 14.75

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting steel	$15.00
No. 2 hvy. melting steel	14.00
No. 1 busheling	14.00
Scrap steel rails	15.00
Steel rails under 3 ft.	16.00
Rails for rolling	16.50
Long turnings	5.00
Cast iron borings	7.50
Stove plate	10.00
Steel axles	18.00
No. 1 RR wrought	14.00
No. 1 cast	16.00
No. 2 cast	12.50
Cast iron carwheels	13.00
Steel car wheels	16.00

DETROIT

Dealers' buying prices per gross ton, f.o.b. cars:

No. 1 hvy. mltng. industrial steel	$15.00 to $15.50
No. 2 hvy. mltng. steel	14.00 to 14.50
Borings and turnings	9.50 to 10.00
Long turnings	9.75 to 10.50
Short shov. turnings	10.50 to 11.00
No. 1 machinery cast	18.00 to 18.50
Automotive cast	18.00 to 18.50
Hvy. breakable cast	14.50 to 15.00
Stove plate	12.50 to 13.00
Hydraul. comp. sheets	16.00 to 16.50
New factory bushel	15.00 to 15.50
Sheet clippings	12.00 to 12.50
Flashings	15.00 to 15.50
Low phos. plate scrap	16.50 to 17.00

NEW YORK

Dealers' buying prices per gross ton on cars:

No. 1 hvy. mltng. steel	$13.50 to $14.00
No. 2 hvy. mltng. steel	11.50 to 12.00
Hvy. breakable cast	15.00 to 15.50
No. 1 machinery cast	17.00 to 17.50
No. 2 cast	13.50 to 14.00
Stove plate	11.50 to 12.00
Steel car axles	19.50 to 20.50
Shafting	19.50 to 20.50
No. 1 RR. wrought	14.50 to 15.50
No. 1 wrought long	13.00 to 13.50
Spec. iron & steel pipe	11.00 to 11.50
Rails for rolling	16.00 to 16.50
Clean steel turnings*	5.50 to 6.00
Cast borings*	5.50 to 6.00
No. 1 blast furnace	5.50 to 6.00
Cast borings (chem.)	10.00 to 11.00
Unprepared yard scrap	7.50 to 8.00
Light iron	5.50 to 6.00

Per gross ton delivered local foundries:

No. 1 machin. cast	$18.00 to $19.00
No. 2 cast	17.00 to 17.50

* $1.50 less for truck loads.

BOSTON

Dealers' buying prices per gross ton:

Breakable cast	$13.00 to $13.25
Machine shop turn.	$6.40
Mixed bor. & turn.	4.50
Bun. skeleton long	10.40
Shafting	17.00 to 17.50
Stove plate	10.00 to 10.50
Cast bor. chemical	8.00 to 8.50

Per gross ton delivered consumers' yards:

Textile cast	$15.50 to $17.00
No. 1 machine cast	15.50 to 17.00

Per gross ton delivered dealers' yards:

No. 1 hvy. mltng. steel	$13.75
No. 2 steel	12.75

PACIFIC COAST

Per net ton delivered to consumer:

	San Fran.	Los Ang.	Seattle
No. 1 hvy. mltng. steel	$12.00	$12.00	$11.00
No. 2 hvy. mltng. steel	11.00	11.00	10.00
Bundles	10.00	10.00	9.00

CANADA

Dealers' buying prices at these yards, per gross ton:

	Toronto	Montreal
Low phos. steel	$11.50	$11.00
No. 1 hvy. mltng. steel	11.00	10.50
No. 2 hvy. mltng. steel	9.75	9.25
Mixed dealers steel	8.75	8.25
Drop forge flashings	9.75	9.25
New loose clippings	8.75	8.25
Busheling	6.00	5.50
Scrap pipe	7.75	7.25
Steel turnings	7.25	6.75
Cast borings	6.75	6.25
Machinery cast	20.00	19.00
Dealers' cast	19.00	18.00
Stove plate	14.00	13.00

EXPORT

Dealers' buying prices per gross ton:

New York, truck lots, delivered, barges	
No. 1 hvy. mltng. steel	$14.00 to $14.50
No. 2 hvy. mltng. steel	12.00 to 12.50
No. 2 cast	12.50 to 13.00
Stove plate	10.50 to 11.00
Boston on cars at Army Base or Mystic Wharf	
No. 1 hvy. mltng. steel	$15.00
No. 2 hvy. mltng. steel	13.50
Rail (scrap)	15.00
Stove plate	$8.00 to 8.25
Philadelphia, delivered alongside boats, Port Richmond	
No. 1 hvy. mltng. steel	Nominal
No. 2 hvy. mltng. steel	Nominal

Construction Steel

. . .STRUCTURAL STEEL, REINFORCING BARS, PLATES, PILING, ETC.

Fabricated Steel

Lettings decline to 10,650 tons from 22,250 tons last week; New projects higher at 10,300 tons; Plate awards call for 1910 tons

AWARDS

NORTH ATLANTIC STATES

1500 Tons, Bessemer, Pa., Dookers Hollow bridge, to Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.

725 Tons, New York, public school No. 99 in Bronx, to Harris Structural Steel Co., Plainfield, N. J.

490 Tons, Queens, N. Y., Bowery Bay sewage treatment works, contract 10, to Ingalls Iron Works Co., Birmingham.

480 Tons, Westchester-Putnam Counties, N. Y., State highway bridge FAGH-RC40-1, to Phoenix Bridge Co., Phoenixville, Pa.

350 Tons, Wilmington, Del., fertilizer plant, to Bethlehem Steel Co., Bethlehem, Pa.

300 Tons, Brooklyn, out-patient building, Kings County Hospital, to Bethlehem Fabricators, Inc., Bethlehem, Pa.

240 Tons, Syracuse, N. Y., Continental Can Co. building, to American Bridge Co., Pittsburgh.

220 Tons, Elmira, N. Y., repairs to Walnut Street bridge, to American Bridge Co., Pittsburgh.

190 Tons, Oswego, N. Y., theater, to Buffalo Structural Steel Co., Buffalo.

190 Tons, Pittsburgh, Lerner store, to Levinson Steel Co., Pittsburgh.

180 Tons, New York, Interzone Corp. addition, 55 Maiden Lane, to American Bridge Co., Pittsburgh.

175 Tons, Brentwood, Pa., building, to Fort Pitt Bridge Works Co., Pittsburgh.

165 Tons, Binghamton, N. Y., Montgomery Ward store, to American Bridge Co., Pittsburgh.

127 Tons, Richmond, Staten Island, N. Y., public school No. 30, to Lehigh Structural Steel Co., Allentown, Pa.

100 Tons, Bayway, N. J., extension to office building, Standard Oil Co. of New Jersey, to an unnamed fabricator.

100 Tons, Darlington, R. I., transmission towers, to Lehigh Structural Steel Co., New York; Stone & Webster, Inc., contractor.

100 Tons, Taunton, Mass., F. W. Woolworth Co. store, to A. O. Wilson Structural Co., Cambridge, Mass.

THE SOUTH

710 Tons, Miami Beach, Fla., Shelborne Hotel for Hatfried Corp., to Bethlehem Fabricators, Inc., Bethlehem, Pa.

555 Tons, Jacksonville, Fla., industrial buildings, to Ingalls Iron Works Co., Birmingham.

170 Tons, Tampa, Fla., four warehouses for Army Department, to Virginia Bridge Co., Roanoke, Va.

160 Tons, Pushmataha County, Okla., bridge FAS-13E, to Fort Smith Structural Steel Co., Fort Smith, Ark.

125 Tons, Oklahoma County, Okla., bridge, FAGS-505B, to Capitol Steel & Iron Co., Oklahoma City.

CENTRAL STATES

580 Tons, Detroit, office and factory addition for Vickers, Inc., to Austin Co., Cleveland.

165 Tons, Milwaukee, Seaman Body Corp. building, to Worden-Allen Co., Milwaukee.

147 Tons, State of Iowa, four State highway bridges, to Des Moines Steel Co., Des Moines.

126 Tons, State of Iowa, three State highway bridges, divided among Clinton Bridge Co., Clinton, Iowa, Rock Island Bridge & Iron Works, Rock Island, Ill., and Illinois Steel Bridge Co., Jacksonville, Ill.

120 Tons, Batavia, Ohio, State project No. 29, to American Bridge Co., Pittsburgh, through Contractors' Finance Corp., Cincinnati.

120 Tons, Flint, Mich., court enclosure for Fisher Body Co., to Whitehead & Kales Co., Detroit.

WESTERN STATES

460 Tons, Lyons, Colo., tunnel ribs, specification 902, to Colorado Fuel & Iron Co., Denver.

345 Tons, Odair, Wash., penstock coaster gates for Grand Coulee Dam (Specifications 905, Schedule 1), to American Bridge Co., Pittsburgh.

270 Tons, Davis, Cal., underpass, to Bethlehem Steel Co., San Francisco, through Heafy-Moore Co. & Fredrickson & Watson Construction Co., Oakland, Cal., contractor.

250 Tons, Los Angeles, plant addition for North American Aviation Corp., to Bethlehem Steel Co., Los Angeles.

250 Tons, Fairbanks, Alaska, power plant at Coldweather Experiment Station, to Midland Steel Co., Cicero, Ill.

154 Tons, Odair, Wash., hydraulic hoists for penstock coaster gates for Grand Coulee Dam (Specifications 905, Schedule 2), to Consolidated Steel Corp., Los Angeles.

154 Tons, Placentia, Cal., piling for Fullerton Dam, to Columbia Steel Co., San Francisco, through Charles U. Heuser, Glendale, Cal., contractor.

125 Tons, Half Moon Bay, Cal., bearing piles for bridges over Pescadero Creek and San Gregorio Creek, to Columbia Steel Co., San Francisco, through Campbell Construction Co., Sacramento, Cal., contractor.

PENDING STRUCTURAL PROJECTS

NORTH ATLANTIC STATES

1300 Tons, Brooklyn, bottling house for Schaefer Brewing Co.

1000 Tons, Kearny, N. J., warehouse for American Stores Co.

410 Tons, Warwick, R. I., bridge.

350 Tons, Hillside, N. J., four highway bridges, route 29, sections 1B and 1C.

300 Tons, Providence, R. I., Forge Road bridge for State.

200 Tons, Schuylkill County, Pa., State bridge.

175 Tons, South Dennis, N. J., bridge over Pennsylvania-Reading Seashore Railroad, route No. 49, section 16.

170 Tons, Gardner, Mass., building for Florence Oil Stove Co.

150 Tons, Hardwick, Mass., State bridge.

150 Tons, Salem, Mass., hospital.

140 Tons, Hardwick, Mass., Gilbertville bridge.

140 Tons, Baltimore, factory building for I-Sekina Co.

140 Tons, Baltimore, Boyola High School recreation building.

120 Tons, Philadelphia, improvements, building No. 12 for Navy Department.

100 Tons, Marcus Hook, Pa., control house for Sun Oil Co.

100 Tons, Danvers, Mass., State bridge.

THE SOUTH

440 Tons, Power, W. Va., coal bunker, etc., for West Penn Power Co.

400 Tons, Watts Bar Dam, Tenn., spillway operating bridge for TVA.

160 Tons, Wheeler Dam, Ala., trash racks for penstock intakes for TVA.

CENTRAL STATES

1350 Tons, Detroit, two grade elimination bridges for State.

540 Tons, Chicago, Ill., warehouse for Sears-Roebuck & Co.

440 Tons, Pontiac, Mich., craneway extension for Yellow Truck & Coach Co.

400 Tons, Hutsonville, Ill., power house, Central Illinois Public Service Co., bids May 31.

220 Tons, Cleveland, Ambler Park Terrace apartment building.

180 Tons, Kanapolis, Kan., dam outlet tunnel, Morrison & Knudsen, Boise, Idaho, low bidders on general contract.

170 Tons, Detroit, building for Fanny Farmer Candy Shops, Inc.

150 Tons, Conneaut, Ohio, State grade crossing project in Ashtabula County. National Construction Co., Cleveland, low bidder.

120 Tons, Toledo, Ohio, office and factory addition for Haughton Elevator Co.

100 Tons, River Rouge, Mich., building for Detroit Wax Paper Co.

100 Tons, La Grange, Ill., building addition, for Electro-Motive Corp.

Unstated tonnage, Mansfield, Ohio, plant expansion for Westinghouse Electric & Mfg. Co.

WESTERN STATES

1200 Tons, Fairbanks, Alaska, hangar at Coldweather Experiment Station; bids in.

475 Tons, Rock Springs, Wyo., overcrossing on A Street and pedestrian undercrossing on C Street; bids May 23.

150 Tons, Kodiak, Alaska, bachelors' headquarters, United States Naval Training Station.

120 Tons, Zurich, Mont., Milk River bridge for State; bids May 24.

FABRICATED PLATES

AWARDS

1100 Tons, Earp, Cal., penstocks for Parker power plant, to Chicago Bridge & Iron Co., Chicago.

572 Tons, outlet pipes for Friant Dam (Specifications 903), to Western Pipe & Steel Co., San Francisco.

235 Tons, Los Angeles, service gates and accessories (Invitation 74), to Commercial Iron Works, Portland, Ore.

SHEET PILING

PENDING PROJECTS

125 Tons, Newark, Ohio, flood control wall and pumping station for U. S. Engineers; bids June 5.

175,950 sq. ft., Mississippi River improvements to locks and dams Nos. 11, 16, 18, 20 and 21; indefinitely postponed.

Reinforcing Steel

Awards of 13,150 tons; 17,210 tons in new projects

AWARDS

ATLANTIC STATES

2000 Tons, Brooklyn, contract No. 2, Long Island Railroad subway, to Truscon Steel Co., Youngstown, through Poirer & McLane Corp., New York.

500 Tons, Fairfield, Conn., Mesh for road, to American Steel & Wire Co.; Sillman & Godfrey Co., Bridgeport, Conn., contractors.

200 Tons, Fairfield, Conn., highway project, to Truscon Steel Co., New York.

175 Tons, West Haven, Conn., Armstrong Rubber Co., building, to Bethlehem Steel Co., Bethlehem, Pa., through Topper & Griggs; Edwin Moss & Son, contractors.

100 Tons, Springfield, Vt., State road, to unnamed bidder.

CENTRAL STATES

580 Tons, Ola, Ark., Nimrod Dam, to Sheffield Steel Corp., Kansas City, Mo., Russ Mitchell, Inc., contractor.

450 Tons, St. Louis, Missouri Pacific Railroad overpass, to Laclede Steel Co., St. Louis, G. L. Tarlton, Inc., contractor.

300 Tons, Toledo, Ohio, Lake Erie water project, division AA, chemical building, to Pollak Steel Co., Cincinnati; previously erroneously reported to Bethlehem Steel Co.

WESTERN STATES

4780 Tons, Los Angeles, Los Angeles River improvement, Section V, to Trojan Steel, Inc., Los Angeles, through Morrison-Knudson Co., Los Angeles, contractor.

1267 Tons, Odair, Wash., Grand Coulee Dam (Invitation B-38232-A), to Bethlehem Steel Co., San Francisco.

770 **Tons,** Los Angeles, Los Angeles River improvement, Downey Road to Atlantic Boulevard, to Soule Steel Co., Los Angeles, through Rohl-Connolly Co., Los Angeles, contractor.
400 **Tons,** Los Angeles, Los Angeles River improvement, Section VI, to Soule Steel Co., Los Angeles, through Shannaham Brothers, Huntington Park, Cal., contractor.
350 **Tons,** Placentia, Cal., Fullerton Dam, to Soule Steel Co., Los Angeles, through Charles U. Heuser, Glendale, Cal., contractor.
265 **Tons,** Missoula, Mont., New Florence Hotel, to Bethlehem Steel Co., through Alloway & Georg, Spokane, contractor.
225 **Tons,** Lakeside, Cal., San Diego River bridge, to Blue Diamond Corp., Los Angeles, through B. G. Carroll and H. L. Foster, San Diego, contractors.
220 **Tons,** Oakland, Cal., Loose-Wiles Biscuit Co. plant, to Herrick Iron Works, Oakland, Cal., through Dinwiddie Construction Co., San Francisco, contractor.
180 **Tons,** Half Moon Bay, Cal., bridges over Pescadero Creek and San Gregorio Creek, to Palm Iron Works, Sacramento, Cal., through Campbell Construction Co., Sacramento, contractor.
180 **Tons,** Colgate, Cal., Pacific Gas & Electric Co. list, to Gilmore Fabricators, Inc., San Francisco.
165 **Tons,** Mono County, Cal., Leevining conduit for Los Angeles Department of Water and Power, to Consolidated Steel Corp., Los Angeles, through A. Teichert & Son, Sacramento, Cal., contractor.
132 **Tons,** Pasadena, Cal., Fremont Avenue undercrossing, to Consolidated Steel Corp., Los Angeles, through Oscar Oberg, Los Angeles, contractor.

PENDING REINFORCING BAR PROJECTS

ATLANTIC STATES

640 **Tons,** Elizabeth, N. J., housing project; bids taken May 22.
260 **Tons,** Philadelphia, Navy Yard shipways No. 3.
200 **Tons,** Bridgeport, Conn., filtration plant.
150 **Tons,** Chicopee Falls, Mass., two Government warehouses.
140 **Tons,** Flushing, N. Y., sewer, contract No. 2, Charles Bennett Improvement Co., Inc., Brooklyn, contractor.
100 **Tons,** Chicopee, Mass., Jones Ferry pumping station.
100 **Tons,** Hillside, N. J., highway project, route No. 29, sections 1B and 1C.
100 **Tons,** South Dennis, N. J., highway project, route No. 49, section 16.

CENTRAL STATES

2500 **Tons,** Chicago, Ill., Goldblatt Bros. store.
1250 **Tons,** Mississippi River improvements to locks and dams Nos. 11, 16, 18, 20 and 21; indefinitely postponed.
1000 **Tons,** Kanapolis, Kan., dam; Morrison & Knudsen, Boise, Idaho, low bidders on general contract.
950 **Tons,** Massillon, Ohio, Wetmore and Sippo Creek high pressure conduits for U. S. Engineers; bids June 8.
700 **Tons,** Relay, Md., Calvert Distilling Co. plant.
650 **Tons,** Detroit, Charles Street housing project.
474 **Tons,** Conneaut, Ohio, State project; National Construction Co., Cleveland, low bidder.
300 **Tons,** Cleveland, Sears-Roebuck store addition; Albert M. Higley Co. general contractor (previously reported).
232 **Tons,** Hichman-Fulton Counties, Ky., highway project No. FAS-329.
105 **Tons,** Ripley, Ohio, State project No. 47; W. H. Ringwald & Sons Co., Chillicothe, Ohio, general contractor.

WESTERN STATES

3000 **Tons,** Oakland, Cal., four fleet supply storehouses (Specifications 9795); bids June 5.
2900 **Tons,** Oakland, Cal., fleet supply storehouse (Specifications 9686); bids in.
1000 **Tons,** Oakland, Cal., marginal wharf at fleet supply base (Specifications 9587); bids June 5.
685 **Tons,** Ogden, Utah, fabric for runways at Hill Field; bids in.
550 **Tons,** Cottage Grove, Ore., Cottage Grove Dam; bids June 14.
520 **Tons,** Odair, Wash., Grand Coulee power plant (Invitation B-38273-A); bids May 29.
325 **Tons,** Fairbanks, Alaska; fabric for runway at Coldweather Experiment Station; bids in.
210 **Tons,** Los Angeles, Pasadena Avenue bridge on Arroyo Seco Parkway; bids in.
210 **Tons,** San Jose, Cal., State College library; bids in.
165 **Tons,** Leavenworth, Wash., bridges on State highways 15 and 2; bids May 28.
160 **Tons,** Marysville, Cal., Honcut Creek bridges; bids June 5.
155 **Tons,** Kremmling, Colo., Colorado-Big Thompson project (Invitation B-46246-A); bids in.
135 **Tons,** Seattle, Wash., terminal warehouse for Swift & Co.
125 **Tons,** Rock Springs, Wyo., overcrossing on A Street and pedestrian undercrossing on C Street; bids May 23.
120 **Tons,** Los Angeles, Big Tujunga Wash bridge; Person & Hollingsworth, Los Angeles, contractor.
115 **Tons,** South Pasadena, Cal., Fair Oaks Avenue and Pacific Electric undercrossings, Arroyo Seco Parkway; bids June 6.
110 **Tons,** Rock Springs, Wyo., M Street undercrossing; bids May 23.

Pipe Lines

Standard Oil Co. of New Jersey, 26 Broadway, New York; Standard Oil Co. of Kentucky, 426 West Bloom Street, Louisville; and Shell Oil Co., Inc., Shell Building, St. Louis, are organizing a joint subsidiary to build new welded steel pipe line from oil field area in Louisiana through Mississippi, Alabama, Georgia and thence to North Carolina, with terminus on Atlantic seaboard in latter State, about 1260 miles in all, for gasoline transmission. Booster pumping stations will be built along route. Investigations and surveys are in progress. Cost close to $15,000,000. Charles Younts, Cranford, N. J., will head new pipe line organization.

Southeastern Pipe Line Co., Forsythe Building, Atlanta, Ga., joint interest of Pure Oil Co., Chicago, and Gulf Refining Co., Pittsburgh, will install 6-in. welded steel pipe line under certain highways in Clayton County, Ga., forming part of pipe line system from Port St. Joe, Fla., to point near Chattanooga, Tenn., now in course of construction, previously referred to in these columns. New line will be about 456 miles long and used for gasoline transmission. Cost about $5,000,000.

Salem, Ill., has plans for new steel pipe line system for municipal natural gas distribution, including main welded steel line to Lake Centralia-Salem gas field area, source of supply, to have capacity for handling about 4,000,000 cu. ft. of natural gas per day. Project will include a control station, meter house and other operating facilities. Bond issue of $275,000 has been authorized. Caldwell Engineering Co., Jacksonville, Ill., is consulting engineer.

Officer in Charge of Construction, Naval Air Station, Jacksonville, Fla., asks bids until June 12 for a steam distribution system at local station, including pipe lines for steam supply and condensate returns, underground conduits, manholes, expansion joints, valves, etc. (Specifications 9790).

Manufacturers Light & Heat Co., Manufacturers Gas Co., and Pennsylvania Fuel Supply Co., all with offices in Union Trust Building, Pittsburgh, now being consolidated into one company of first noted name, plan new welded steel pipe line from West Virginia to points in south central part of New York for natural gas transmission.

Constructing Quartermaster, Fort Myer, Va., asks bids until June 17 for pipe line extensions for gasoline fueling system for Air Corps, Bolling Field, D. C. (Circular 6141-38).

Coronado Corp., Continental Building, Dallas, Tex., is installing pipe line gathering system in La Rosa field, near Refugio, Tex., for gas supply for recycling plant in same area. Contract was let recently to Gasoline Plant Construction Corp., Second National Bank Building, Houston, Tex. Cost over $50,000.

Ontario, Cal., has taken bids for furnishing 1440 ft. of 12-in. and 3700 ft. of 10-in. welded steel pipe.

Prices on Finished Iron and Steel...

Steel prices on these pages are f.o.b. basing points (in cents per lb.) unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	
Long ternes[2]	3.80¢		3.80¢									4.35¢			
Wrought iron	4.75¢														
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢		
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	Worcester =		3.00¢			2.90¢		
Cooperage stock	2.20¢	2.20¢													
Commodity C-R	2.95¢			2.95¢			2.95¢	Worcester =		3.35¢			3.05¢		
TIN PLATE Standard cokes (Per 100-lb. base box)	$5.00	$5.00	$5.00						$5.10						
BLACK PLATE 29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢			
TERNES, M'FG. Special coated (Per base box)	$4.30		$4.30						$4.40						
BARS															
Soft steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	Duluth = 2	.25¢		2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢	2.05¢					2.40¢	2.70¢			
Reinforcing (billet)[7]	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢			2.20 to 2.25¢	2.25 to 2.30¢	1.80 to 2.00¢		
Reinforcing (rail)[7]	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢	1.70 to 1.90¢				2.20 to 2.25¢	2.25 to 2.30¢	1.80 to 2.00¢		
Cold finished[8]	2.65¢	2.65¢	2.65¢			2.65¢							2.70¢		
PLATES															
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	Coatesville and Claymont = 2.10¢		2.45¢	2.65¢		2.29¢	2.15¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	
SHAPES Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		Bethlehem = 2.10¢			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			Worcester =	3.00¢							
0.51 to 0.75 Carbon	4.30¢			4.30¢			Worcester =	4.50¢							
0.76 to 1.00 Carbon	6.15¢			6.15¢			Worcester =	6.35¢							
1.01 to 1.25 Carbon	8.35¢			8.35¢			Worcester =	8.55¢							
WIRE[9]															
Bright	2.60¢	2.60¢		2.60¢	2.60¢										
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢										
Spring	3.20¢	3.20¢		3.20¢	3.20¢										
PILING Steel sheet	2.40¢	2.40¢				2.40¢					2.85¢	2.95¢			
IRON BARS															
Common		2.25¢			Terre Haute, Ind. =			2.15¢							
Refined	3.75¢														
Wrought	4.40¢														

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to 29 gage within certain width and length limitations. [6] For merchant trade. [7] Straight lengths as quoted to distributers. The so-called published price on new billet reinforcing bars is 2.15c. a lb. f.o.b. major basing points, and on rail reinforcing bars is 2.00c. a lb. The price range shown above, however, represents the going price at the present time. [8] Also shafting. For quantities of 20,000 to 39,999 lb. [9] Carload lots to manufacturing trade.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (Rerolling only). Prices delivered Detroit are $2 higher f.o.b. Duluth, billets only, $2 higher.

Per Gross Ton

Rerolling $34.00
Forging quality 40.00

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

Per Gross Ton

Open hearth or bessemer..... $34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

Per Lb.

Grooved, universal and sheared. 1.90c.

Wire Rods

(No. 5 to 9/32 in.)

Per Lb.

Pittsburgh, Chicago, Cleveland 2.00c.
Worcester, Mass. ..... 2.10c.
Birmingham ..... 2.00c.
San Francisco ..... 2.50c.
Galveston ..... 2.25c.

9/32 in. to 47/64 in., $3 a net ton higher. Quantity extras apply.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh; Package, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C...	$6.00	$12.00
15-lb. coating I.C...	7.00	14.00
20-lb. coating I.C...	7.50	15.00
25-lb. coating I.C...	8.00	16.00
30-lb. coating I.C...	8.63	17.25
40-lb. coating I.C...	9.75	19.50

WIRE PRODUCTS

(To the Trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

Base per Keg

Standard wire nails $2.55
Coated nails 2.55
Cut nails, carloads 3.85

Base per 100 Lb.

Annealed fence wire $3.05

Base Column

Woven wire fence*..... 67
Fence posts (carloads)..... 69
Single loop bale ties..... 56
Galvanized barbed wire†..... 70
Twisted barbless wire..... 70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Per Cent Off List

Machine and carriage bolts:
½ in. and 6 in. and smaller....68½
Larger and longer up to 1 in...66
1⅛ in. and larger.....64
Lag bolts 66
Plow bolts, Nos. 1, 2, 3, and 7....68½
Hot pressed nuts; c.p.c., t-nuts; square, hex., blank or tapped:
½ in. and smaller.....67
9/16 in. to 1 in. inclusive.....64
1⅛ in. to 1½ in. inclusive.....62
1⅝ in. and larger.....60

On above items, excepting plow bolts, additional allowance of 10 per cent for full container quantities.

On all of the above items there is an additional 5 per cent allowance for carload shipments.

Semi-fin. hexagon nuts	U.S.S.	S.A.E.
½ in. and smaller.....	67	70
9/16 to 1 in.....	64	65
1⅛ in. through 1½ in..	62	62
1⅝ in. and larger.....	60	60

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose 72½
Stove bolts in packages, with nuts attached, add 15% extra.
Stove bolts in bulk.....83½

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York, lots of 200 lb. or over.

Large Rivets

(1½ in. and larger)

Base per 100 Lb.

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham $3.40

Small Rivets

(7/16 in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham .....65 and 10

Cap and Set Screws

Per Cent Off List

Milled hexagon head, cap screws, 1 in. dia. and smaller.....50 and 10
Milled headless set screws, cut thread ¼ in. and larger..... 64
3/16 in. and smaller..... 73
Upset hex. head cap screws U.S.S. or S.A.E. thread 1 in. and smaller 70
Upset set screws, cup and oval points 75
Milled studs 52

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

NON-FERROUS PRICES

Cents per lb. for early delivery

	May 15	May 16	May 17	May 18	May 20	May 21
Copper, Electrolytic[1]* ..	11.50	11.50	11.50	11.50	11.50	11.50
Copper, Lake	11.50	11.50	11.50	11.50	11.50	11.50
Tin, Straits, New York..	51.50	52.50	53.50	....	54.00	54.00
Zinc East St. Louis[2]....	5.75	5.75	5.75	5.75	5.75	5.75
Lead, St. Louis[3]	4.85	4.85	4.85	4.85	4.85	4.85

* Mine producers' quotations only.

[1] Delivered Conn. Valley. Deduct ¼c. for approximate New York delivery price. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Warehouse Products

Cents per lb., Delivered

	New York	Cleveland
Tin		
Straits pig	55.00	56.50
Copper		
Lake	13.25	12.625
Electro	12.75	12.625
Castings	12.375	12.375
H. R. sheets*.....	20.12	20.12
Seamless tubes*	20.62	20.62
Brass		
Yellow, sheets*	18.31	18.31
Yellow, rods*	13.26	13.26
Seamless tubes*	21.06	21.06
Zinc		
Slabs	7.10	7.75
Sheets, No. 9 casks..	12.00	12.00
Lead		
American pig	6.10	5.50
Bar	8.05	8.25
Cut sheets.....	8.25	8.25
Antimony		
Asiatic	16.00	17.00
Aluminum		
Virgin, 99%	20.50	21.50
No. 1 remelt., 98-99%	18.00	18.50
Solder		
½ and ½.....	33.25	32.50
Babbitt		
Anti-friction grade..	22.15	22.00

Old Metals

Cents per lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators. Selling prices are those charged to consumers after the metal has been prepared for their use.

	Dealers' Buying Prices	Dealers' Selling Prices
Copper		
Hvy. crucible.....	9.375	10.00
Hvy. and wire....	8.375	8.75
Light and bottoms	7.50	8.00
Brass		
Heavy	5.00	5.50
Light	4.125	4.875
No. 1 yel. turn.....	4.75	5.75
No. 1 red or compo. turn.	7.375	8.875
Lead		
Heavy	4.00	4.375
Aluminum		
Cast	8.00	9.00
Sheet	13.00	14.00
Zinc	3.00	3.75
Hvy. mach. compo.	7.75	8.375

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 19c.-20c. a lb.; No. 12 remelt No. 2 standard, 18c.-19c. a lb. NICKEL, electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt: Asiatic, 16.50c. a lb., New York; American, 13c. a lb., f.o.b. smelter. QUICKSILVER, $176 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 12c. a lb.

*These prices, which are also for delivery from Chicago warehouses, are quoted with the following percentages allowed off for extras: on copper sheets, 33⅓; on brass sheets and rods, 40; on brass tubes, 33⅓, and copper tubes, 40.

ALLOY STEEL

Alloy Steel Blooms, Billets and Slabs

Base per gross ton, f.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem.....$54.00

Alloy Steel Bars

Base per pound, f.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.

Open-hearth grade ..... 2.70c.
Delivered, Detroit ..... 2.80c.

S.A.E. Series Numbers	Alloy Differential, per 100 Lb.
200 (1.5 Ni)	$0.35
2100 (1.5 Ni)	0.75
2300 (3.5 Ni)	1.55
2500 (5 Ni)	2.25
31 Ni-Cr	0.70
3200 Ni-Cr	1.85
3300 Ni-Cr	3.80
3400 Ni-Cr	3.20
4100 Cr-Mo (0.15 to 0.25 Mo.)	0.55
4100 Cr-Mo (0.25 to 0.40 Mo.)	0.75
4340 Cr-Ni-Mo	1.65
4345 Cr-Ni-Mo	1.85
4600 Ni-Mo (0.2-0.3 Mo,1.5-2 Ni)	1.10
5100 (0.60-0.90 Cr)	0.35
5100 (0.80-1.10 Cr)	0.45
6100 Cr spring steel	0.15
6100 Cr-V bar	1.20
6100 Cr-V spring steel	0.85
Cr-Ni-V	1.50
C-V	0.85

The above differentials are for hot rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base.

Alloy Cold-Finished Bars

Base per pound, f.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 3.35c. Delivered Detroit, 3.45c., carlots.

STAINLESS AND HEAT-RESISTANT ALLOYS

(Base prices, cents per lb., f.o.b. Pittsburgh)

Chromium-Nickel

No.	304	302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium

No.	410	430	442	446
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
H't strip	17.00c.	17.50c.	24.00c.	35.00c.
C'ld st.	22.00c.	22.50c.	32.00c.	52.00c.

TOOL STEEL

(F.o.b. Pittsburgh)

	Base per Lb.
High speed	67c.
High-carbon-chromium	43c.
Oil-hardening	24c.
Special	22c.
Extra	18c.
Regular	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

ELECTRICAL SHEETS

(F.o.b. Pittsburgh)

	Base per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 70c. a 100 lb.

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. dock, San Francisco or Los Angeles or Seattle	56.00

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes. Minimum Wall.

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld, Hot Rolled
1 in. o.d. 13 B.W.G.	$9.01	$7.82	....
1¼ in. o.d. 13 B.W.G.	10.67	9.26	....
1½ in. o.d. 13 B.W.G.	11.70	10.23	$9.72
1¾ in. o.d. 13 B.W.G.	13.42	11.64	11.06
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2¼ in. o.d. 13 B.W.G.	16.76	14.54	13.79
2¼ in. o.d. 12 B.W.G.	18.45	16.01	15.16
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
2¾ in. o.d. 12 B.W.G.	21.42	18.59	17.54
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66
4½ in. o.d. 10 B.W.G.	43.04	37.35	35.22
5 in. o.d. 9 B.W.G.	54.01	46.87	44.25
6 in. o.d. 7 B.W.G.	82.93	71.96	68.14

Extras for less carload quantities:

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2.000 lb. or ft.	65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought iron pipe)

Base Price=$200 Per Net Ton

Butt Weld

Steel	Black	Galv.
⅛ in.	56	36
¼ to ⅜ in.	59	43½
½ in.	63½	54
¾ in.	66½	58
1 to 3 in.	68½	60½
Wrought Iron	**Black**	**Galv.**
¼ and ⅜ in.	+9	+30
½ in.	24	6½
¾ in.	30	13
1 and 1¼ in.	34	19
1½ in.	38	21½
2 in.	37½	21

Lap Weld

2 in.	61	52½
2½ and 3 in.	64	55½
3½ to 6 in.	66	57¼
7 and 8 in.	65	55½
9 and 10 in.	64½	55
11 and 12 in.	63½	54
2 in.	30½	15
2½ to 3½ in.	31½	17½
4 in.	33½	21
4½ to 8 in.	32½	20
9 to 12 in.	28½	15

Butt weld, extra strong, plain ends

⅛ in.	54½	41½
¼ to ⅜ in.	56½	45½
½ in.	61½	53½
¾ in.	65½	57½
1 to 3 in.	67	60

	Black	Galv.
¼ and ⅜ in.	+10	+43
½ in.	25	9
¾ in.	31	15
1 to 2 in.	38	22½

Lap weld, extra strong, plain ends

2 in.	59	51½
2½ and 3 in.	63	55½
3½ to 6 in.	66½	59
7 and 8 in.	65½	56
9 and 10 in.	64½	55
11 and 12 in.	63½	54
2 in.	33½	18½

	Black	Galv.
2½ to 4 in.	39½	25½
4½ to 6 in.	37½	24
7 and 8 in.	38½	24½
9 to 12 in.	32	20½

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher, on all butt weld 8 in. and smaller.

ORES

Lake Superior Ores

Delivered Lower Lake Ports

	Per Gross Ton
Old range, bessemer, 51.50%..	$4.75
Old range, non-bessemer, 51.50%	4.60
Mesaba, bessemer, 51.50%....	4.60
Mesaba, non-bessemer, 51.50%	4.45
High phosphorus, 51.50%.....	4.35

Foreign Ores*

C.i.f. Philadelphia or Baltimore, Exclusive of Duty

	Per Unit
Algerian, low P, Cu free, dry, 55 to 58% Fe.....	14c.
Caucasian, washed, 52% Mn...	50c.
African, Indian, 44 to 48% Mn.	46c.
African, Indian, 49 to 51% Mn.	49c.
Brazilian, 46 to 48% Mn.....	47c.
Cuban, del'd, duty free, 51% Mn	62c.

	Per Short Ton Unit
Tungsten, Chinese, Wolframite, duty paid, delivered	$23.00 to $23.50
Tungsten, domestic scheelite, delivered	23.00 to 23.50
Chrome ore, lump c.i.f. Atlantic Seaboard, per gross ton:	
South African (low grade)..	$19.00
Rhodesian, 45%.....	22.00
Rhodesian, 48%.....	26.00 to 27.00

*All foreign ore prices are nominal. War conditions have prevented trading in Swedish and Turkish ores and all quotations have therefore been withdrawn.

FLUORSPAR

	Per Net Ton
Domestic washed gravel, 85-5, f.o.b. Kentucky and Illinois mines, all rail.....	$20.00
Domestic, f.o.b. Ohio River landing barges	20.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines..	$20.50 to 22.00
Foreign, 85% calcium fluoride, not over 5% Si., c.i.f. Atlantic ports, duty paid....	$25.00 to $25.50
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines....	$31.00
As above, in bags, f.o.b. same mines	$32.60

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works
Super-duty brick, at St. Louis..	$60.80
First quality Pennsylvania, Maryland, Kentucky, Missouri and Illinois	47.50
First quality, New Jersey.....	52.50
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois.....	42.75
Second quality, New Jersey....	49.00
No. 1 Ohio	39.90
Ground fire clay, per ton.....	7.10

Silica Brick

Pennsylvania	$47.50
Chicago District	55.10
Birmingham	47.50
Silica cement, net ton (Eastern)	8.55

Chrome Brick

	Net per Ton
Standard f.o.b. Baltimore, Plymouth Meeting and Chester...	$50.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	50.00

Magnesite Brick

Standard f.o.b. Baltimore and Chester	$72.00
Chemically bonded, f.o.b. Baltimore	61.00

Grain Magnesite

Imported, f.o.b. Baltimore and Chester, Pa. (in sacks).....	(—)*
Domestic, f.o.b. Baltimore and Chester in sacks	$40.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

*None available.

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

Per Gross Ton

Domestic, 80% (carload).....$100.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....$32.00
Domestic, 26 to 28%..... 39.50

Electric Ferrosilicon

Per Gross Ton, Delivered, Lump Size

50% (carload lots, bulk).....$69.50*
50% (ton lots, packed)..... 82.00*
75% (carload lots, bulk).....126.00*
75% (ton lots, packed) 142.00*

Bessemer Ferrosilicon

Per Gross Ton, F.o.b. Jackson, Ohio

10.00 to 10.50%.....$33.50

For each additional 0.50% silicon up to 12%, 50c. per ton is added. Above 12% add 75c. per ton.

For each unit of manganese over 2%, $1 per ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Silvery Iron

Per Gross Ton, F.o.b. Jackson, Ohio

5.00 to 5.50%.....$27.50

For each additional 0.5% silicon up to 12%, 50c. a ton is added. Above 12% add 75c. a ton.

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese, each unit over 2%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Ferrochrome

Per Lb. Contained Cr., Delivered Carlots, Lump Size, on Contract

4 to 6% carbon.....11.00c.
2% carbon .....17.50c.
1% carbon .....18.50c.
0.10% carbon .....20.50c.
0.06% carbon .....21.00c.

Spot prices are ½c. per lb. of contained chromium higher.

Silico-Manganese

Per Gross Ton, Delivered, Lump Size, Bulk, on Contract

3% carbon $98.00*
2.50% carbon 103.00*
2% carbon 108.00*
1% carbon 118.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del. carload..... $2.00
Ferrotungsten, 100 lb. and less 2.25
Ferrovanadium, contract, per lb. contained V., del'd $2.70 to $2.90†
Ferracolumbium, per lb. contained columbium, f. o. b. Niagara Falls, N. Y., ton lots ..... $2.25†
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace, carload and contract, per net ton.....$142.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton.....$157.50
Ferrophosphorus, electric or blast furnace material, in carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton $58.50
Ferrophosphorus, electrolytic 23-26% in carlots, f.o.b. Monsanto (Siglo), Tenn., 24%, per gross ton, $3 unitage, freight equalized with Nashville $75.00
Ferromolybdenum, per lb. Mo, f.o.b. furnace..... 95c.
Calcium molybdate, per lb. Mo, f.o.b. furnace ..... 80c.
Molybdenum oxide briquettes 48-52% Mo, per lb. contained Mo, f.o.b. Langeloth, Pa. 80c.

*Spot prices are $5 per ton higher.
†Spot prices are 10c. per lb. of contained element higher.

FUEL OIL

Per Gal.

No. 3, f.o.b. Bayonne, N. J.....5.40c.
No. 6, f.ob. Bayonne, N. J.....3.57c.
No. 5 Bur. Stds., del'd Chicago..3.25c.
No. 6 Bur. Stds., del'd Chicago..2.75c.
No. 3 distillate, del'd Cleveland.5.25c.
No. 4 industrial, del'd Cleveland.5.00c.
No. 5 industrial, del'd Cleveland.3.75c.
No. 6 industrial, del'd Cleveland.3.25c.

COKE

Per Net Ton

Furnace, f.o.b. Connellsville, prompt .....$4.00 to $4.25
Foundry, f.o.b. Connellsville, prompt .....$5.25 to 5.50
F'dry, by-product, Chicago.... 10.50
F'dry, by-product, New England 12.50
Foundry, by-product, Newark or Jersey City .....$11.30 to $11.90
F'dry, by-product, Philadelphia 11.13
F'dry, by-product, Cleveland... 11.05
F'dry, by-product, Cincinnati.. 10.50
Foundry, Birmingham 7.50
F'dry, by-product, St. Louis $10.75 to $11.00
Foundry, from Birmingham, f.o.b. cars dock Pacific ports.....$14.75

BRITISH AND CONTINENTAL

British

Per Gross Ton, f.o.b. United Kingdom Ports

Ferromanganese, export. £17 18s.
Tin plate, per base box 32s. to 33s.
Steel bars, open hearth 13£ 9s.
Beams, open hearth.... 12£ 2s. 6d.
Channels, open hearth.. 12£ 2s. 6d.
Angles, open hearth.... 12£ 2s. 6d.
Black sheets, No. 24 gage 17£ max.*; 17£ min.**
Galvanized sheets, No. 24 gage 19£ 10s. max.*; 19£ 10s. min.**

*Empire markets only.
**Other than Empire markets.

Continental

Per Gross Ton, Belgian Francs, f.o.b. Continental Ports

Bars, merchant 1500
Plates 1750
Joists 1475
Sheets, thin 1900

Above prices are minimum base to which 100 francs should be added to cover war risk insurance, freight charges, etc.

PIG IRON (Per Gross Ton)

Prices delivered various consuming points indicated by italics

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phos.
Boston	***$24.50***	***$24.00***	***$25.50***	***$25.50***	.....
Brooklyn	***26.50***	.....	.....	***27.00***	.....
Jersey City	***25.53***	***25.06***	***26.53***	***26.03***	.....
Philadelphia	***24.84***	***24.34***	.....	***25.34***	.....
Bethlehem, Pa.	$24.00	$23.50	$25.00	$24.50	.....
Everett, Mass.	24.00	23.50	25.00	24.50	.....
Swedeland, Pa.	24.00	23.50	25.00	24.50	.....
Steelton, Pa.	.....	23.50	.....	.....	28.50
Birdsboro, Pa.	24.00	23.50	25.00	24.50	28.50
Sparrows Point, Md.	24.00	23.50	.....	.....	.....
Erie, Pa.	23.00	22.50	24.00	23.50	.....
Neville Island, Pa.	23.00	22.50	23.50	23.00	.....
Sharpsville, Pa.	23.00	22.50	23.50	23.00	.....
Buffalo	23.00	22.00	24.00	23.50	28.50
Cincinnati	***23.44***	***23.61***	.....	***24.11***	.....
Canton, Ohio	***24.39***	***23.89***	***24.89***	***24.39***	.....
Mansfield, Ohio	***24.94***	***24.44***	***25.44***	***24.94***	.....
St. Louis	***23.50***	***23.02***	.....	.....	.....
Chicago	23.00	22.50	23.50	23.00	.....
Granite City, Ill.	23.00	22.50	23.50	23.00	.....
Cleveland	23.00	22.50	23.50	23.00	.....
Hamilton, Ohio	23.00	22.50	.....	23.00	.....
Toledo	23.00	22.50	23.50	23.00	.....
Youngstown	23.00	22.50	23.50	23.00	.....
Detroit	23.00	22.50	23.50	23.00	.....
St. Paul	***25.63***	.....	***26.13***	***25.63***	.....
Duluth	23.50	.....	24.00	23.50	.....
Birmingham	19.38*	18.00	24.00	.....	.....
Los Angeles, San Francisco and Seattle	***26.50***	.....	.....	.....	.....
Provo, Utah	21.00	.....	.....	.....	.....
Montreal†	27.50	27.50	.....	28.00	.....
Toronto†	25.50	25.50	.....	26.00	.....

GRAY FORGE

Valley or Pittsburgh fce.....$22.50

CHARCOAL

Lake Superior fce.....$27.00
Delivered Chicago 30.34

*Delivered prices on Southern iron for shipment to Northern points are 38c. a ton below delivered prices from nearest Northern basing point on iron with phosphorus content of 0.70 per cent and over. †On all grades 2.25 per cent silicon and under is base. For each 25 points of silicon over 2.25 per cent an extra of 25c. is charged.

WAREHOUSE PRICES

(Base Prices, Dollars per 100 lb., Delivered Metropolitan Areas)

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	$3.15	$3.05	$3.15	$3.35	$3.38	$3.23	$3.05	$3.51	$3.45	$3.18	$3.60	$3.48	$4.10
Sheets, cold rolled	....	4.10	4.05	4.35	4.40	4.30	4.30	4.58	....	4.12	4.95	4.43	6.30
Sheets, galvanized	4.75	4.60	4.72	4.75	4.30	4.84	4.45	4.66	4.75	4.95	5.00	4.98	5.25
Strip, hot rolled	3.40	3.40	3.30	3.75	3.76	3.48	3.62	3.86	3.70	3.52	....	3.73	....
Strip, cold rolled	3.00	3.30	3.20	3.31	3.31	3.20	3.22	3.26	....	3.41	3.83	3.54	....
Plates	3.40	3.55	3.40	3.55	3.76	3.60	3.62	3.85	3.35	3.47	3.80	3.68	4.00
Structural shapes	3.40	3.55	3.58	3.55	3.75	3.65	3.40	3.85	3.55	3.47	3.80	3.68	4.00
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.62	3.75	3.63	4.15
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.20	7.10	7.30	7.31	7.35	7.42	7.10	7.50	....	7.47	7.45	7.33	9.40
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	....	6.02	6.00	5.88	8.55
Bars, cd. drn. SAE 2300	8.15	8.15	8.15	8.56	8.59	8.45	8.15	8.63	....	8.52	8.84	8.38	10.65
Bars, cd. drn. SAE 3100	6.75	6.75	6.75	7.16	7.19	7.05	6.75	7.23	....	7.12	7.44	6.98	9.80

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb.; galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions: Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, less than 1500 lb., cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb.; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb.; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 150 to 499 lb.; New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, hot rolled sheets, bars, plates, shapes, cold rolled sheets, 300 to 1999 lb., galvanized sheets, 150 to 1049 lb. Extras for size, quality, etc., apply on above quotations.

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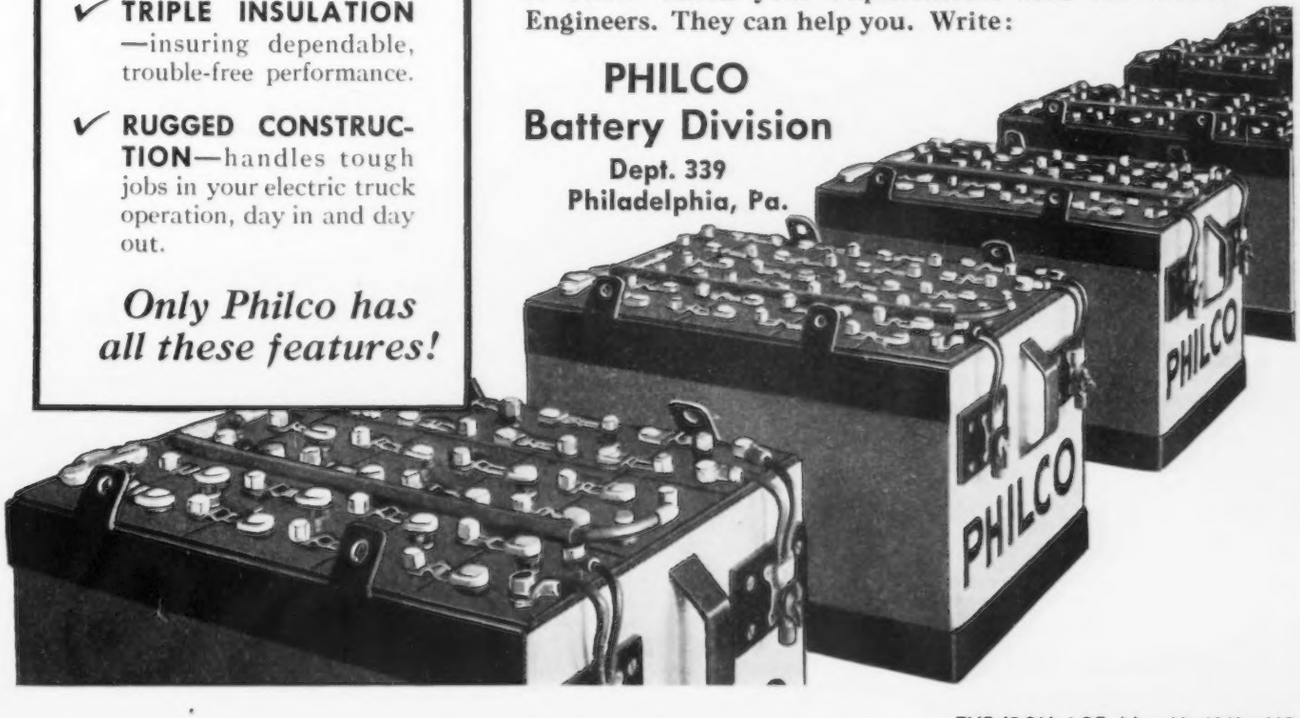


Sales Possibilities

. . . CONSTRUCTION, PLANT EXPANSION AND EQUIPMENT BUYING

NORTH ATLANTIC

Texas Co., 135 East Forty-second Street, New York, plans new bulk oil terminal for water and rail service on Tennessee River at Chattanooga, Tenn., comprising several one-story buildings, steel tanks, pumping station and other facilities, with floating steel barge, 16 ft. wide and 40 ft. long. Cost close to $100,000 with equipment. Company also plans other similar water-rail bulk terminal plants at Nashville, Tenn.; Sheffield and Guntersville, Ala.

National Biscuit Co., 449 West Fourteenth Street, New York, has low bid from William Tamminga, Tramway Building, Denver, Colo., at $359,044 for one and two-story baking plant, 214 x 435 ft., at East Fortieth Avenue and Steele Street, Denver, exclusive of equipment, for which contracts will be made separately. Entire project will cost close to $1,000,000 with traveling ovens, conveyors and other equipment. Louis Wirsching, first noted address, is company architect.

Consolidated Edison Co., Inc., 4 Irving Place, New York, has taken out a permit for bulk oil storage and distributing terminal at 19-39 Twentieth Avenue, Astoria, L. I., consisting of four 2,000,000-gal. steel tanks and auxiliary equipment, for oil supply for power plants. Cost about $400,000. Earl L. Griffith is company engineer.

Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, asks bids until June 3 for connectors, plugs, fittings, etc. (Circular 441).

Fritzsche Brothers, Inc., 76 Ninth Avenue, New York, essential oils, chemical products, etc., will take bids soon on general contract for two-story and basement addition to plant on Third Street, Clifton, N. J. Cost over $150,000 with equipment. Epple & Kahrs, 17 Washington Street, Newark, N. J., are architects.

DeVoe & Raynolds Co., Inc., 383 Hamilton Avenue, Brooklyn, paints, oils, varnishes, etc., is negotiating for property at Perth Amboy, N. J., for establishment of a large plant. City Commission has been informed that building on Rector Street, owned by E. I. du Pont de Nemours & Co., will be taken over, provided railway siding is arranged. Structure will be remodeled and equipment installed to give initial employment to about 250 men.

John A. B. Greulich, 79 Vincent Street, Newark, N. J., machinist and millwright, has acquired one-story building at 307-11 Stephens Street, Belleville, N. J., for plant. Present property has been taken over by Newark Housing Authority and will be vacated soon.

Griffith Laboratories, Inc., 1415 West Thirty-seventh Street, Chicago, food packer's supplies, has let general contract to Fatzler Co., 653 South Fifteenth Street, for one and two-story factory branch, storage and distributing plant, 100 x 220 ft., on Empire Street, Newark. Cost about $90,000 with equipment. William E. Lehman, 972 Broad Street, Newark, is architect. A. Epstein, 2001 West Pershing Road, Chicago, is engineer.

Commanding Officer, Ordnance Department, Frankford Arsenal, Bridesburg, Philadelphia, asks bids until June 3 for 30 to 75 sets of control equipment for automatic gun, 37 mm., and sets of spare parts (Circular 1502).

Weiland Packing Co., 551 West Bridge Street, Phoenixville, Pa., meat packer, has asked bids on general contract for two-story addition. Cost close to $40,000 with equipment. Widdicombe Engineering Co., 1700 Sansom Street, Philadelphia, is engineer.

Pennsylvania Woven Wire Co., Lock Haven, Pa., wire cloth and other wire goods, has approved plans for one-story addition. Cost about $40,000 with equipment.

Public Works Officer, building No. 1, Navy Yard, Philadelphia, asks bids until May 29 for one 10-ton and one 5-ton overhead traveling bridge cranes for naval aircraft factory (Specifications 9280).

NEW ENGLAND

Hartford Electric Steel Co., 540 Flatbush Avenue, Hartford, Conn., has let general contract to Peter Bell, 25 Abbottsford Avenue, West Hartford, for one-story addition, 20 x 105 ft. Cost over $45,000 with equipment. Adolf Feinberg, Hartford, is architect.

Commanding Officer, Ordnance Department, Springfield Armory, Springfield, Mass., asks bids until May 27 for multi-spindle drilling head, with rotary index table, work-holding fixtures and 12 sets of high-speed tools (Circular 384).

Louis H. Weiner, Inc., 318 Crown Street, New Haven, Conn., mechanical equipment, has let general contract to A. Weinstein & Son, 102 Edgewood Avenue, for two-story machine shop, 40 x 95 ft. Cost about $40,000 with equipment. C. H. Abramowitz, 52 Goffe Terrace, is architect and engineer.

Superior Castings Co., Water Street, South Norwalk, Conn., gray iron castings, is erecting new one-story foundry on Meadow Street, 74 x 210 ft., with two one-story extensions, 45 x 50 ft., and 20 x 27 ft., for which general contract recently was let to Hewlett Construction Co., 1385 Iranistan Avenue, Bridgeport, Conn. Cost over $65,000 with equipment. Leo F. Caproni, 1221 Chapel Street, New Haven, Conn., is architect and engineer.

Bureau of Yards and Docks, Navy Department, Washington, plans new one-story powder-manufacturing plant at naval torpedo station, Newport, R. I. Cost about $200,000 with equipment.

Draper Corp., Hopedale, Mass., is considering bids for one-story plant addition. McClintock & Craig, 458 Bridge Street, Springfield, Mass., are architects.

WASHINGTON DIST.

Purchasing and Contracting Officer, Quartermaster Depot, Baltimore, asks bids until May 29 for three, one ton each, two-wheel trailers (house trailer type) (Circular 398-203).

Board of Awards, Administration Building, Baltimore, asks bids on general contract until May 29 for three-story air station at municipal airport, with two-story control tower and other operating facilities. Cost about $225,000 with equipment. Thomas Machen, 312 North Charles Street, is architect; W. Watters Pagon, Lexington Building, is consulting engineer.

Executive Officer, National Archives, Washington, asks bids until June 4 for two truck-tractors and three semi-trailer units (Circular 469).

General Purchasing Officer, Panama Canal, Washington, asks bids until May 28 for electric fans, fractional hp. motors, connecting links for transmission system, knife switches, sleeve twisters, carbon brushes and other equipment (Schedule 4048).

City Council, Hagerstown, Md., will take bids soon for extensions and improvements in municipal power plant, including new boiler units and other equipment. Wood & Kirkpatrick, Stock Exchange Building, Philadelphia, are consulting engineers.

Allen-Morrison Sign Co., Rutherford Street, Lynchburg, Va., signs and displays, plans one-story and part basement addition, 60 x 310 ft. Cost close to $50,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until May 28 for nippers and pliers (Schedule 1606), screw drivers (Schedule 1605), pneumatic drills, grinders and hammers (Schedule 1617), motor-driven drill grinder (Schedule 1616), general purpose shovels (Schedule 1624), axes, hammers, hatchets, etc. (Schedule 1631), vises (Schedule 1630) for Eastern and Western Navy yards; 21 galvanized cast iron anchors in two lots of same quantity (Schedules 1634 and 1635) for Norfolk and Mare Island yards.

BUFFALO DISTRICT

Allegheny Ludlum Steel Corp., Dunkirk, N. Y., has let general contract to Meister Contracting Co., 12 West Third Street, for one-story addition, 70 x 80 ft., for expansion in machine shop. Cost close to $40,000 with equipment. Company also will begin superstructure at once for two other one-story units, 60 x 210 ft., and 80 x 180 ft., in part for expansion in wire mill, for which general contract recently was let to Gillmore, Carmichael-Olson Co., 1873 East Fifty-fifth Street, Cleveland. Cost over $100,000 with machinery. Main offices are in Oliver Building, Pittsburgh.

Erie Electric Motor Repair Co., Inc., 120 Church Street, Buffalo, plans rebuilding part of plant recently destroyed by fire. Loss close to $50,000 with equipment.

SOUTH ATLANTIC

Nantahala Power Co., Franklin, N. C., plans early resumption of construction of hydroelectric power plant on Nantahala River, Macon County, N. C., on which work was begun several months ago and later temporarily discontinued. It will consist of power dam, 260 ft. high and 880 ft. long, with power station for initial capacity of 63,090-kva. Company also plans another hydroelectric power development on West Fork of Tuckasegee River, near Glenville, N. C., with power dam, 148 ft. high and 820 ft. long, and 30,000-kva. power station. Projects will include new transmission lines, switching stations and other operating structures. A considerable part of output will be used by Carolina Aluminum Co., Badin, N. C., an affiliated organization. Entire project will cost over $1,000,000.

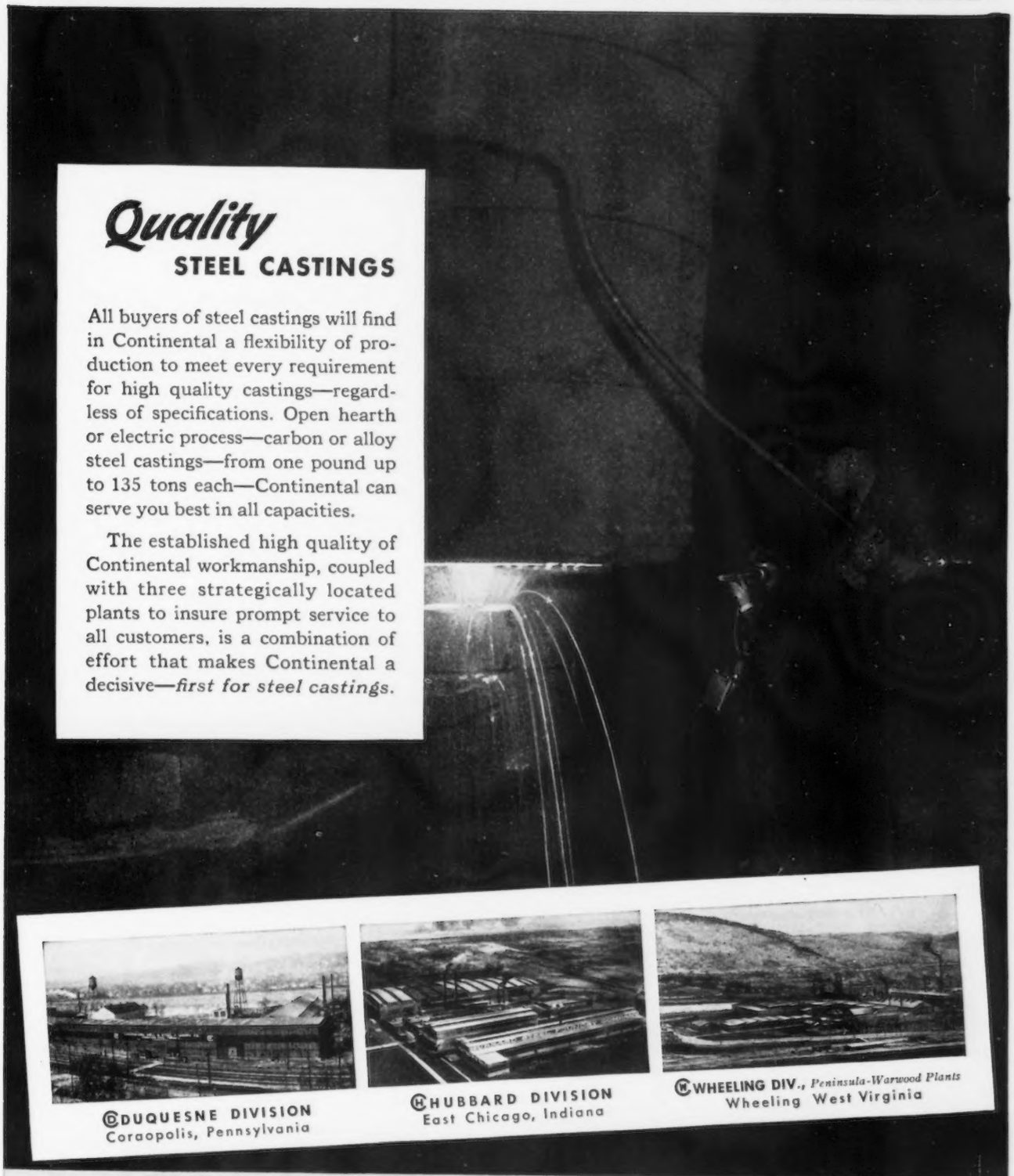
Pepsi-Cola Bottling Co., 152 N. E. Eleventh Street, Miami, Fla., has let general contract to Southeastern Construction Co., Security Building, for one-story mechanical-bottling, storage and distributing plant. Cost over $45,000 with equipment.

SOUTH CENTRAL

Buckeye Cotton Oil Co., Floyd and K Streets, Louisville, cottonseed oil products, has asked bids on general contract for additions to processing plant to handle about 2,000,000 bu. of raw material per annum, consisting of six-story extraction unit, 36 x 50 ft.; three-story preparation building, 36 x 65 ft.; and one-story storage and distribution building, 64 x 120 ft. Cost over $100,000 with equipment. Walter C. Wagner, Breslin Building, is architect. Company is a subsidiary of Procter & Gamble Co., Cincinnati.

Chesapeake & Ohio Railroad Co., Richmond, Va., has let general contract to Ogle Con-

CONTINENTAL



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STEEL CASTINGS

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The established high quality of Continental workmanship, coupled with three strategically located plants to insure prompt service to all customers, is a combination of effort that makes Continental a decisive—*first for steel castings.*

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Coraopolis, Pennsylvania

Ⓗ HUBBARD DIVISION
East Chicago, Indiana

Ⓦ WHEELING DIV., *Peninsula-Warwood Plants*
Wheeling West Virginia

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

CHICAGO • PITTSBURGH

struction Co., 28 East Jackson Boulevard, Chicago, for new coaling station, with tipple and other structures, at Covington, Ky., yards. Cost over $40,000 with equipment.

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until May 29 for steel spillway operating bridge for Watts Bar power dam.

Coca-Cola Bottling Co., 1527 Church Street, Nashville, Tenn., has let general contract to N. E. Yearwood, 1701 Church Street, for new one-story mechanical-bottling plant, including adjoining service and garage unit. Cost over $45,000 with equipment. George D. Waller, Third National Bank Building, is architect.

WESTERN PA. DIST.

Sun Oil Co., 1608 Walnut Street, Philadelphia, has let general contract to E. E. Austin & Son, 1919 Reed Street, Erie, Pa., for new bulk oil storage and distributing plant at Erie, including tanks and other facilities. Cost over $55,000 with equipment.

Unatin Seven-Up Co., Beaver Falls, Pa., has let general contract to James Perrott, 407 Sixth Avenue, New Brighton, Pa., for two-story and basement mechanical-bottling, storage and distributing plant, 35 x 95 ft. Cost about $40,000 with equipment. J. E. Martsolf, 513 Third Avenue, New Brighton, is architect.

Board of Education, Administration Building, Pittsburgh, H. W. Cramblet, secretary, plans vocational training department in new three-story school on Bedford Avenue, for which bids will be asked on general contract in July. Cost about $350,000. M. M. Steen, address noted, is architect.

SOUTHWEST

A. Leschen & Sons Rope Co., 5909 Kenerly Avenue, St. Louis, wire rope, cables, etc., has asked bids on general contract for one-story addition, 35 x 150 ft. Traveling crane and other mechanical-handling equipment will be installed. Cost over $65,000 with equipment.

Chicago, Rock Island & Pacific Railroad Co., 500 East Main Street, Oklahoma City, Okla., has asked bids on general contract for one-story machine shop at works at El Reno, Okla. Cost close to $50,000 with equipment. Main offices are in Chicago.

John Deere Plow Co., 2103 Walker Street, Houston, Tex., agricultural implements, will take bids soon on general contract for new one-story plant on Navigation Boulevard, including parts production and assembling departments. Cost over $125,000 with equipment.

Industrial Engineering Co., Gulf Building, Houston, Tex., has leased about five acres on Homestead Road, Burchfield industrial district, for new pipe-coating plant for oil and gas pipe lines, etc., comprising one-story units for production of asphalt and mastic, priming shop, shot blast shop, power house and other structures. Cost close to $100,000 with equipment. W. W. Colley, 710 Bankers' Mortgage Building, is president.

Board of Directors, Willacy County Water Control and Improvement District No. 1, Raymondville, Tex., asks bids until June 1 for pumping machinery, centrifuge oil purifier and other equipment for irrigation project.

OHIO AND INDIANA

Mansfield Metal Vault Co., Mansfield, Ohio, will take bids soon on general contract for new one-story plant. Cost close to $45,000 with equipment.

Willard Storage Battery Co., East 131st Street and St. Clair Avenue, Cleveland, electric batteries, has approved plans for additions to branch plant at Dallas, Tex., one-story, 65 x 120 ft., and two stories, 30 x 60 ft. Cost close to $80,000 with equipment.

Krauth & Benninghofen, 940 Symmes Avenue, Hamilton, Ohio, manufacturers of autographic registers, etc., have asked bids on general contract for plant extensions and improvements, including one-story addition to manufacturing division. Cost over $45,000 with equipment. Fred G. Mueller, Hamilton Hotel, is architect; Willard C. Pistler, 4 West Seventh Street, Cincinnati, is consulting engineer.

Ohio Grape Juice Association, Geneva, Ohio, has asked bids on general contract for new one-story plant, including processing and manufacturing departments, mechanical-bottling, storage and distributing divisions. Cost close to $100,000 with equipment.

Contracting Officer, Materiel Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until May 27 for engine control pawl brackets, engine control lever stop pawls, spacer assemblies, engine control lever spacers, springs, etc. (Circular 1528); until May 29 for inertia brake testing machine (Circular 1526).

Guide Lamp Division, General Motors Corp., Twenty-sixth Street, Anderson, Ind., automobile lamps and lighting devices, plans one-story addition, 200 x 600 ft. Cost close to $500,000 with equipment.

Vonnegut Hardware Co., 120 East Washington Street, Indianapolis, has let general contract to Carl M. Geupel Construction Co., Hume-Mansur Building, for two-story and basement storage and distributing building, 160 x 240 ft., at Maryland and Missouri Streets. Cost over $85,000 with equipment. Vonnegut & Bohn, Indiana Pythian Building, are architects; Charles R. Ammerman, Century Building, is mechanical engineer.

MICHIGAN DISTRICT

Fisher Body Division, General Motors Corp., Detroit, has let general contract to Barton Marlow Co., 1900 East Jefferson Street, for one-story addition to plant No. 10, 1591 Theodore Street, and improvements in present building. Cost close to $50,000 with equipment.

Kalamazoo Paper Co., Kalamazoo, Mich., writing and other paper stocks, is arranging an appropriation of about $250,000 for expansion and improvements in mill, including additional equipment for production and replacements.

Tucker Mfg. Co., Ypsilanti, Mich., manufacturer of armament, has acquired building of Kraetke Co., East Grand Boulevard, Detroit, and will remove works to that location, where expansion will be carried out to handle Government contracts.

Midland Steel Products Co., 6660 Mount Elliott Avenue, Detroit, is building addition to steam power house, for which general contract recently was let to Emil Van Wulfen, 431 West Hilldale Street. Additional equipment will be installed.

MIDDLE WEST

International Harvester Co., 606 South Michigan Avenue, Chicago, has asked bids on general contract for one-story addition, 147 x 685 ft., to branch plant at Fort Wayne, Ind., and improvements in present buildings. Cost over $450,000 with equipment.

Goodrich Electric Co., Inc., 2901 North Oakley Avenue, Chicago, lighting reflectors and electrical specialties, has let general contract to Carl E. Erickson Co., Inc., 2847 North Clark Street, for one-story addition, 80 x 215 ft., and improvements in present two-story building. Cost over $65,000 with equipment. Alfred Alschuler, Inc., 28 East Jackson Boulevard, is architect.

Signal Corps Procurement District, 1819 West Pershing Road, Chicago, asks bids until May 28 for about 11,000 ft. of switchboard cable and reels (Circular 274); until June 3, coils, capacitors, generators, cranks, handsets, etc. (Circular 264).

Winnebago County Highway Department, Oshkosh, Wis., has asked bids on general contract for one and two-story addition to service and garage building for highway equipment, 80 x 105 ft. A 5-ton traveling crane and other equipment will be installed. Cost about $50,000 complete. Sandstedt & Knoop, 22 Otter Street, are architects.

Midland Rubber Co., 207-11 A Avenue, N. E., Cedar Rapids, Iowa, mechanical rubber goods, hard rubber products, etc., has acquired site for one-story mill addition, for which plans will be prepared at once. Cost over $45,000 with equipment.

City Council, Brookings, S. D., asks bids until May 27 for two spreader-type overfeed stokers for watertube boilers in municipal power plant.

Felter Motor Co., Fifth and Beach Streets, Lamar, Colo., has let general contract to Birkby Lumber Co., Lamar, for one-story addition, 50 x 80 ft., for a machine shop. Cost close to $40,000 with equipment.

Twin Disc Clutch Co., Racine, Wis., expects to get under way immediately a $140,000 expansion program now that City Council has amended zoning ordinance. New building will make room for employment of 100 men.

Chain-Belt Co., Milwaukee, has commissioned Eschweiler & Eschweiler, 720 E. Mason Street, Milwaukee, to design one-story addition to its plant at 1600 W. Bruce Street.

PACIFIC COAST

Lockheed Aircraft Corp., Burbank, Cal., has let general contract to H. W. Baum, 500 Westmoreland Avenue, for one-story assembly building No. 9, about 35,000 sq. ft. of floor space. Cost close to $100,000 with equipment. John and Donald B. Parkinson, Title Insurance Building, Los Angeles, are architects.

Commanding Officer, Ordnance Department, Benicia Arsenal, Benicia, Cal., asks bids until May 28 for motor-driven milling machine, with electrical equipment and additional attachments (Circular 64).

United States Rubber Co., 1790 Broadway, New York, and Portland, Ore., has let general contract to Ertz-Burns & Co., Pittock Block, Portland, for remodeling four-story and basement building, 100 x 200 ft., on N. W. Irving Street, recently secured under lease, for new factory branch, storage and distributing plant. Cost over $60,000 with equipment.

Associated Telephone Co., 1314 Seventh Street, Santa Monica, Cal., will take bids soon on general contract for new equipment storage, distributing and repair plant consisting of eight one-story shop units. Cost over $90,000 with equipment. W. Horace Austin, 532 Chestnut Avenue, Long Beach, Cal., is architect.

Johnston Fruit Co., Santa Barbara, Cal., has approved plans for new one-story packing, storage and distributing plant, 285 x 300 ft., at East Santa Barbara. Cost over $100,000 with equipment. William W. Ache, 301 North Citrus Avenue, Los Angeles, is architect.

Administrator, Bonneville Project, Department of Interior, 811 N. E. Oregon Street, Portland, Ore., asks bids until May 31 for pole line and guy hardware for 115-kv. transmission line from Covington to Tacoma, Wash., Bonneville transmission system (Circular 1017).

City Council, Salem, Ore., has plans for two-story mechanical and repair shop, 100 x 148 ft., at Thirteenth and Ferry Streets, for municipal service. Cost close to $45,000 with equipment. J. H. Davis is city engineer.

CANADA

British-American Oil Co., Ltd., Canada Cement Building, Montreal, plans expansion and improvements in oil refinery in East Montreal district, including equipment. Cost over $80,000 with machinery.

Burger Lighting Equipment Co., 11 Duncan Street, Toronto, electrical equipment, has leased space in buildings at King and Bathurst Streets, for plant, expanding present output.

Ontario Paper Co., Ltd., Thorold, Ont., has let general contract to Newman Brothers, Ltd., 127 St. Paul Street, St. Catherines, Ont., for one-story steam power house at newsprint mill. Cost close to $100,000 with equipment.